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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[NOTICE.]

Announcement of the Third Annual Meeting, Iowa District Gas Association.

The Third Annual Meeting of the Iowa District Gas Association will be held in Cedar Rapids, Ia., June 12th, 13th and 14th.

Headquarters and place of meeting will be at the Montrose Hotel. The Hotel offers rates on the American plan of $2.50 per day up, and European plan $1 per day up. Best accommodations are always secured by reservations made in advance.

In addition to the regular set papers, the Council has decided upon the following topics for general discussion as being of broad interest to all members of the Association. The subjects will not be specifically assigned, but the Chairman will call upon the various members for their ideas and experiences in any or all of the subjects:

"Removal and Disposal of Tar."

"Purification."

"Prepaid Meters."

"Removing Meters versus Shutting-Off Gas with or without Lock Cocks."

"Minimum Charges."

The following papers will be presented:

"Experiences in Operating Water Gas Machines," by Mr. L. H. Reuping, Sioux City, Ia.

"Attitude of Gas Companies Toward the Public," by Mr. Jansen Haines, Des Moines, Ia.

"The Organization of Gas Companies in Towns of Less Than 10,000 Inhabitants," by Mr. Geo. H. Waring, Omaha, Neb.

"High Pressure Transmission," by Mr. L. H. Lawlor, Waterloo, Ia.

"Arc Lamp Maintenance: Methods and Results," by Mr. J. C. Grey, Des Moines, Ia.

"New Business," by Mr. A. W. Zahm, Mason City, Ia.

"Accidents and Damages," by Mr. G. M. Averill, Cedar Rapids, Ia.

"Standard Methods in Service: Meter and Appliance Fittings."—Short Topic, by Mr. G. I. Vincent, Des Moines, Ia.

The "Wrinkle Department" will be conducted by Mr. H. D. Mitchell, St. Charles, Mo.

Every gas man in Iowa, Nebraska and South Dakota is expected to attend the meeting.

G. I. VINCENT, Secy. and Treas.

[NOTICE.]

Wrinkle Department, The American Gas Institute.

To the Membership, American Gas Institute: All members of The American Gas Institute, and others interested, are requested to contribute a description of any novel device or scheme covering any feature of the gas business. Every department of every Company uses some novel stunt which would be of value to others. The object of this department is to compile such information. The value of the report depends entirely on the co-operation received. Send in your contribution at once to

MILAN R. BUMP, Editor,
60 Wall street, New York.

BRIEFLY TOLD.

OBITUARY NOTE: MR. THOMAS B. RITER.—Some time ago we were called upon to announce the death of Mr. Thomas B. Riter, well known to every gas man in the country as the head of the famous iron working house, in Pittsburgh, Pa., known as the Riter-Conley Manufacturing Company, and this mention is made of his life work conformably to our promise. Thomas B. Riter was born in York, Pa., December 22, 1840, and received his education there. At an early age he became connected with the iron trade and removed to Pittsburgh about 1860. In 1858 the partnership of Riter & Conley was formed, the brother (Mr. James Riter) of deceased being the senior member. Deceased entered their employ and served the partnership well in many responsible posi-

LIBRARY OF CONGRESS, JUN 10 1907, SMITHSONIAN DEPOSIT.

tions. Mr. James Riter died in 1873, and the business, which had then assumed considerable magnitude, was taken over by Messrs. Thomas B. Riter and W. H. Conley, still under the firm name of Riter & Conley. In 1895 the title was changed to that of the Riter-Conley Company. In July, 1897, Mr. Conley died, and on September 30th of the following year the concern was incorporated under the name of the Riter-Conley Manufacturing Company. Largely due to the mechanical skill, courage, planning and personality of deceased is traced the magnitude of the Company's trading, which it may be said easily amounts now in the converting of 100,000 tons of raw stuff into finished products in the course of a year, and whose mammoth shops at Allegheny and Leetsdale, Pa., cover many acres of ground, give employment to thousands of men, and are as completely equipped as any other shops in the world for the constructing of entire plants for the working up of iron and steel into almost any shape and for any use in iron, steel, gas, sugar and kindred plants. The Company has executed some of the largest contracts that have ever been awarded to a single concern, its specialty being to include and cover everything, from foundations to the finished plant, ready to turn out the product for which it was intended of a specific quality and at a specific cost. One particular aim or direction of the house was not to promise to deliver anything at a certain date unless there was a surety that the promise could be performed. In 1896 the gas division of the Riter-Conley concern was started and that it was successful is well shown by the many large gasholders erected under its supervision in many cities of the country, and in its generating division of gas works as well. Noble specimens of the latter can be seen in the Astoria plant of the New York Consolidated Gas Company, in Lowell, Mass., and another large example will be completed this year in Worcester, Mass. In 1875 he was united in marriage to Miss Sophia A. McCallin, by whom he is survived, also a son, Mr. Joseph Riter. His home life was a singularly happy one, and it was in reality through parental grief that his death was hastened. About 3 years ago his health was somewhat impaired, and later on the sudden death of his only daughter, who had been married less than a year, so shocked him that he never rallied. Resolute, skillful, untiring and lovable, Mr. Riter's death will be mourned by the many with whom he labored, assisted and associated. For the facts in this short history we are indebted to the courtesy of Mr. Henry A. Carpenter, who served him long and who esteemed him well.

CURRENT COMMENT.—

A CORRESPONDENT, in Los Angeles, Cal., writing under date of the first inst., and referring particularly to the progress that is being made on the new works under construction there for the City Gas Company of Los Angeles, says that the Company will be under the direct management of Mr. Alexander Ross, whose services in connection with the Laclede Gas Light Company of St. Louis are well known. The Stacey Manufacturing Company is under contract to erect a storage holder up to retaining 1,000,000 cubic feet, also a relief holder having a capacity of 150,000 cubic feet, and two 4-box sets of Chollar purifiers; the other apparatus is virtually contracted for. Orders for 2,500 tons of cast pipe, 10 to 16 inches diameter, and 150 miles of wrought pipe of 3, 4 and 6 inches diameter are placed. The plant is laid out to produce 4,000,000 cubic feet per diem, or an all crude oil system. The plot on which it is to stand comprises 20 acres, and the scheme includes a complete briquetting plant for preparing the lampblack residual as solid fuel. There is a ready market in Los Angeles for it. The offices of the Company are in the Wilcox Building, and the President is Mr. J. F. Sartori.

RECENT contracts awarded to the Gas Machinery Company, of Cleveland, O., are: By the Chattanooga (Tenn.) Gas Company, complete coal gas apparatus, a Pintsch gas apparatus and a 48 inch ammonia concentrator. Also a new, modern purifier installation for the Mohawk (N. Y.) Gas Company in its Schenectady division.

PROF. JOHN WHITE, Chief of the Chemical Section of the Rose Polytechnic Institute, having been appointed by the city authorities of Terre Haute, Ind., to test the quality of the gas supplied by the Citizens Gas and Fuel Company, of that city, which the growlers had been claiming was much under the regulating statute, reported that a careful examination of the same showed the values to be well above those stipulated.

MR. CHAS. E. WHITE has been appointed Chief of the New Business Department of the Union Gas and Electric Company, vice Mr. E. E. Miller, resigned. Mr. Wm. A. Miller has been chosen General Manager of the gas section of the Company, vice Mr. E. H. Earnshaw, resigned.

The Production of Coke and Its Application in Domestic Fires.

[Read by MR. PAUL SCHLICHT, Society of Arts, London.]

The honor you do me by your presence to-night impels me to ask your kind indulgence if it appear to you that I do not bring to my subject a knowledge co-extensive with its importance. I bring, however, the devotion of a close student of coal and its uses, the experience of a more than ordinary zealous and industrious experimentalist, and the consciousness of having achieved a certain measure of success in devising simple methods of improving combustion that are daily contributing to the comfort of thousands, and to the economic use of fuel, in and about the city of New York. My recent activities that have had to do with the production of by-product coke for metallurgical purposes and the advocacy of the production of improved coke by gas companies, have led me to investigate the different methods of coke and gas production in the United States, England, Germany, Austria and Belgium, with a view to finding the best and simplest methods.

Although I may seem to exceed the limits of my subject, I have touched upon other matters only because they seem to me to have direct bearing thereon:

I accordingly divide my paper into the following parts:

1. The use of bituminous coal.
2. The production of coke.
3. Kinds of coke.
4. Application of coke in domestic fires.
5. New method of combustion.

The Use of Bituminous Coal.—The impression vaguely prevails that the *per capita* consumption of coal is a fair criterion of a nation's rank in the world's civilzation. The truth of this statement, however, depends upon whether the use approaches the highest economic standards of the day, or, if not, whether the abundance of a country's coal resources excuses misuse and waste.

Applying these preliminary remarks to England, it does not seem to me, from the report of the last Royal Commission on the Coal Supply, that the validity of the contention of the late Professor Jevons, supplemented by the later more careful statistical calculations of Mr. Price Williams, as to the early exhaustion of the coal fields of England, is materially affected. Yet raw coal continues to be "destructively" distilled, and what is worse, the lungs of the public continue to be impregnated with carbonaceous matter and sulphuric acid, attenuated, it is true, by the immense quantities of water, in the form of steam, that each little chimney pot throws out. Why is it that only the wholesale industrial atmosphere polluters are prosecuted and the equally guilty house dwellers continue their more insidious, if homeopathic, air poisoning unmolested? Let us look across the Atlantic. It can be truly said, at least of the eastern portion of the United States, that the atmosphere is not blackened by domestic fires. Anthracite is the popular fuel, but latterly by-product coke has come into vogue in the communities where it is being produced.

Shortly after the adoption of bituminous coal as a fuel in England, a Royal Proclamation was issued forbidding its use, and authorizing the destruction of the furnaces of the users, who were characterized as evildoers. Scarcity of fuel it seems shortly compelled the resumption of its use. In the reign of Elizabeth, bituminous coal was again prohibited during sessions of Parliament, lest the health of the members should suffer thereby.

Hygienic objections to bituminous coal must have been gradually overcome in London, or the inhabitants must have grown more indifferent than in a simpler age, for deaths by the hundreds of thousands are traceable to the poisonous and fog-contributing exhalations its improper use gives rise to, according to reliable chroniclers.

It must be said, however, that in recent years, thanks to the admirable and disinterested efforts of the Coal Smoke Abatement Society, and the exploitation of gas as a substitute for coal by the gas companies, the atmosphere of London is much less offensive than it was 25 or 30 years ago.

With your kind permission, I will introduce on the screen two photographs loaned me by the Gas Light and Coke Company, of London, showing the effect of chimney smoke on the atmosphere, the one taken before the lighting of fires in the early morning, the other some 3 or 4 hours afterwards. These photographs were taken from the roof of Cannon street Station, and tell their own story.

For many years the smoke nuisance of London has really been indefensible. In Washington, the capital of the United States, there is no smoke nuisance. The owner of a furnace as well as the stoker is

each liable to fine and imprisonment. This is full of suggestiveness for London. In New York until recently, practically a smokeless city, it is true that certain large fuel users, feeling obliged to work their boilers to the bursting point, use bituminous coal on dark nights, and thus evade the lynx-eyed smoke inspector. The condition of the atmosphere the next morning, however, is tell-tale.

Fig. 1.

When one looks at a bright, cheerful, open fire, radiating its genial warmth, even though only a little way, into the room, one rarely stops to think what it is that is actually taking place.

The process we witness is aptly called "destructive." Yes, this coal, so laboriously extracted from the bowels of the earth, that men daily risk their lives to secure, that is screened and picked and loaded in cars

Fig. 2.

and vessels, unloaded by hand or ingenious mechanism, stored by the coal merchant, and made the subject of trusts and syndicates, how much of it in this wanton work of distillation is actually made to serve a useful purpose, and how much is destroyed or passes off as a polluting or fog promoting emanation?

In addition to wastefully heating about fourteen times the air necessary to burn the coal and generously sending it out of the chimney into the open, together with enough water in the form of steam, impregnated with sulphuric acid, to produce a miniature fog, we destroy per ton of coal burned, as high as 100 hundred pounds of coal tar, countless constituents valuable in the arts and medicine, oils that give promise of success as the basis of illuminants and heating agents, and that are already being used for motor purposes as substitutes for petrol, as well as heavier oils, together with solids that can be employed advantageously in road making and road improvements, in addition to their regular commercial uses; considerable quantities of ammonia, useful in the arts and invaluable in the form of sulphate of ammonia for agricultural and other purposes; cyanogen, in not inconsiderable quantities, either in the rough as prussiate of soda, or that may be converted into the various cyanogen products of commerce.

If this same ton of coal were used in the modern by-product oven there would be in addition to the products named, 14 cwt. of coke suitable for domestic and metallurgical purposes which improved coke can be made to serve a much more useful purpose than the raw coal giving in addition thereto at least 5,000 cubic feet of gas suitable for illumination, heating, and power purposes.

The poverty and inadequacy of these utterances respecting a popular use of bituminous coal, I fully realize when I consider the beautiful distillates that discovery and invention have enabled us to recover from this misused product of the sun's rays in the form of solids—crystalline and pulverulent of all the beautiful colors of the rainbow—liquids of varying specific gravities and boiling points, gaseous constituents capable of many combinations. I leave this task to those more learned than I. The name of a great Englishman, Perkin, springs to the lips when this subject is adverted to. What a service he has rendered mankind! Small wonder then that the late Sir William Siemens (then Mr. C. William Siemens) in 1881 in an address before the Glasgow Science Lecture Association, declared: "I am bold enough to go so far as to say that raw coal should not be used as fuel for any purpose." And this was before the advent of the modern by product oven and its successful use in the manufacture of illuminating gas and a high-grade coke!

I cannot conclude my remarks on the use of bituminous coal without quoting from the report of an address delivered at the recent annual meeting of the Coal Smoke Abatement Society at which the King's surgeon, Sir Frederick Treves, stated that he could personally say from what he had seen of the lungs of dead persons in London that they were absolutely black on the surface and down to their very depths; that the trouble caused by impure air was the starting point of serious diseases, and appalling misery that words could not portray. He added that the sooty substance blocked the lymphatic vessels and also the bronchial glands and lessened their power to resist disease, that the lung of the smoke-breather was already compromised, and that this appalling combination of soot and sulphuric acid was a great irritant to it; that all kinds of catarrh and bronchitis were produced by this matter, and catarrh was the starting point for more serious trouble in the chest. That fog would exaggerate to an intense degree all forms of lung trouble and killed Londoners not only by hundreds but by thousands. I was not present at this meeting and, therefore, quote from the newspaper reports this portentous warning.

Reverting again to the genial open fire, the passion for which would seem to warrant the designation of fire-worshippers to the Anglo Saxon race. Are there not improvements at hand for using this raw bituminous coal, now so wastefully burned, that pollutes the air, contributes to fogs, poisons the blood, hastens death, and requires the dwellers of cities to make periodic pilgrimages to regions of purer air? Yes, or fuel that does not smoke, that will burn brightly, radiate more heat, last longer, can, as I have before stated, be produced from this very coal if the gas companies in London and elsewhere in England can be shown the economic advantage to be secured by adopting the modern by-product oven so successfully employed in the United States. A high-grade of coke of different kinds can be economically produced in such ovens, of varying degrees of density, porosity and clean volatile matter, by merely varying the coking periods. Flaming coke for instance can be made in from 4 to 5 hours less time than the low volatile coke required for metallurgical purposes, a certain percentage of hydrogen and hydrocarbons that during the latter part of the coking period require much heat to expel, being allowed to remain in the coke. Coke for metallurgical purposes which should have less than 1 per cent. of volatile matter can be made in the same ovens, thus supplying fuel for domestic, metallurgical and other industrial needs.

The Production of Coke.—Coke may be described as the carbonaceous residual of bituminous coals remaining after the expulsion, by heat, of the larger part of their volatile constituents. While production between 1612 and 1621 seems certain, there is little reliable information as to who is really responsible therefor. Professor Jevons, relying on a work called "Metallum Martis," by Dud Dudley, natural son of Lord Dudley, containing accounts of the author's invention of the use of pit coal for melting iron about 1620, and, later, of making coke from the small coals left in the pit, awards to Dudley the honor of having by this simple economic expedient laid the foundation of the iron industry of to day. Records in His Majesty's Patent Office, however, cast doubt on these statements. In Patent No. 15 granted by King James in 1620 to Sir William St. John, Sir Giles Mompesson, Sir George Ayloff, Lewis Powell, Walter Vaughan, John Prothero, Henry Vaughan, Henry Stubbes and Hugh Grundy, these patentees agree for themselves and their executors to pay for the privilege "the sum of 5 shillings for every ton of iron, steel, brass, lead, copper, etc.," they may "make, fine, produce, or work by with such charred fuels." The patent contains the following recital: "Whereas as heretofore upon the several information first of one Simon Sturtevant and afterwarde of John Robinson made unto us, that they had found a way to 'Melte, produce, and make iron and divers other metalls and materialls with seal-coale, earth-coale, pit-coale, peat, turf, and brush, and such other like fuelle,'" a patent was granted them. The recital further states that this grant is cancelled, first, because the parties did nothing, and, second, because the method would be valueless "unless the coal be by some means corrected and purged from the sulphur or other contagious mixtures they contain;" but being informed by Sir John and others that "they have found

ways and means to charke the several fuels of sea-coale whereby the same may be fit and serviceable as well for the uses aforesaid as well as other uses," they are granted the monopoly "to charke coal." Attached to the copy of these Letters Patents in the Patent Office Library, done into modern English, I find a paper that contains evidence that this early syndicate did not turn out as well as King James or the other syndicate expected, for Sir Giles Mompesson, one of the syndicate that had agreed to pay into the Royal coffers five shillings royalty per ton of iron made, was, on the 26th March, 1621, degraded from the order of knighthood, the degradation to "occur whenever he shall be taken," his lands were declared forfeited, a fine of £10,000 imposed, "and lastly, he shall be for ever held as an infamous person."

The next patent has to do with coal products in which coke appears to be referred to as "cinders." I quote from it to show the then state of the coal products art. In 1781 there was granted to Archibald, Earl of Dundonald, a patent, for "A Method of Extracting or making Tar, Pitch, Essential Oils, Volatile Alkalies, Mineral Acids, Salts, and *Cinders*." (Italics mine.)

I summarize a portion of the patent. The coals, after being kindled, are enabled by their own heat and without the assistance of any other fire to throw off, in a distillation or vapor, the oils they contain. Persons doing this will be deemed to encroach this patent, because, as he avers the only means known until his new discovery was "a distillation of coal in closed vessels where the admission of external air was prevented and where other fuel and coal were required besides the coals contained in the closed vessel to produce the heat necessary to pervade the same." This patent was extended as the Earl had used up all his resources in attempting to put the invention into practical use.

In 1783 Jean de Cannolle, described as "late of Paris but now of Piccadilly, London, Mineralist," obtained a patent for "a factitious coal to supply the use of charcoal more efficient in its qualities and perfectly innocent in its effects." His claim is, "The making, fabricating, or manufacturing of a factitious fuel by charring."

The production of coke in early times was doubtless due to recognition of the advantage, as a concentrated heat producer, of a dense, hard, homogeneous substitute for charcoal and pit coal for the melting of iron. The process was called charking or coking, and was carried on in a manner analogous to that employed in the production of wood charcoal. The process passed through successive evolutions.

Whether coke be made in the primitive mounds, in ovens, heated wholly or in part by the gases evolved from the coal within the oven, or heated externally, the process as has already been stated consists, essentially, of the expulsion, to a greater or less extent, of the volatile constituents of the coal. The longer the coking period, heats being equal, the harder the coke and the freer it is from volatile matter. The latter portion of the coking period requires the expenditure of the greatest amount of heat. It requires 5 to 8 days to coke in mounds, it requires 48 and 72 hours respectively in bee-hive ovens, and the coking period in the modern regenerative oven has been reduced to 24 hours for metallurgical coke, and 18 hours for domestic and industrial cokes which do not require the complete expulsion of the gaseous portions of

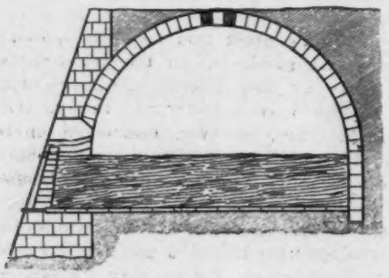


Fig. 3.—Bee-Hive Oven.

the coal, but are, in fact, preferable therewith on account of their flame-producing properties, greater porosity, and ease of ignition.

The art of making coke as practised to-day, consists, generally speaking, in the expulsion by the heat furnished in the burning of all, or a portion of the gaseous constituents of the coal (1) within a coking chamber into which restricted quantities of air are admitted; or (2) heated externally thereby in a chamber from which air is excluded. The device for carrying out this art consists of ovens of fire-proof material.

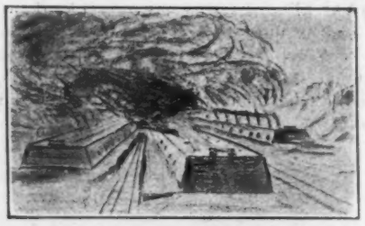


Fig. 4.—Bee-Hive Oven Wastes.

Ovens are roughly divisible into bee-hive ovens and retort ovens.

The bee-hive oven may be divided into (*a*) ordinary ovens in which all products except the coke are wasted, and (*b*) waste heat ovens in which the products are carried away by means of flues that their hea, may be made to serve a useful purpose.

The retort oven may be divided into horizontal and vertical. The horizontal ovens may be divided into (*a*) non-by-product ovens, and (*b*) by-product ovens with horizontal or vertical heating flues. These may be further divided into non-recuperative and recuperative, and non-regenerative and regenerative. The vertical oven is a by-product oven, and usually non-regenerative. The coal is fed into the top of

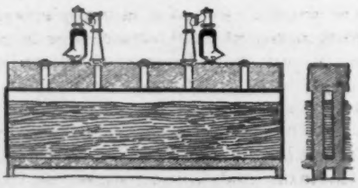


Fig. 5.—Retort Oven.

the oven, and the coke discharged by gravity from the bottom of the oven. The charge is usually about 2 tons; the coking period with certain coals in as short a period as six hours.

The bee-hive oven is generally round, its diameter 12 to 15 feet, and its height 8 to 10 feet. The horizontal retort oven, which is the type of the modern by-product oven, has a long, narrow arched coking chamber, with doors at each end, and may be from 30 to 40 feet in length, 18 to 22 inches in width, and 5 to 8 feet in height. In the bee-hive oven the coal is coked in a heap. Heat reflected from the dome ignites the coal. Coking proceeds from the top downward. The coke is quenched within the oven and is withdrawn by manual labor. In the retort oven a long, narrow, high body is acted upon through the heating flues of the side walls. This narrow body is more quickly and effectively acted on than the large heap of coal in the bee-hive oven. Moreover, the charging and discharging of the coal can be done by machinery and the coke quenched in the open. The coking period with the retort oven is shorter, especially where there are regenerators, and coals that do not readily lend themselves to the coking process, can, in the retort system, be compressed, moistened and charged into the coking chamber in one long, narrow cake, and produce coke of a quality impossible of production in the bee-hive oven.

The well-known retort ovens may be divided into those with horizontal and those with vertical flues. The type of horizontal flued oven is represented by the Semet Solvay, the Huessener, the Simon-Carvés and the Röthberg. The vertical flued oven by the Coppée, Otto-Hoffmann, Otto-Hilgenstock, Collin, Koppers and Von Bauer.

The vertical retort oven that deserves mention is the Appolt, first built about 1856, but generally superseded by the larger horizontal retort oven. Other vertical ovens are mere modifications of the Appolt.

The modern by-product oven seems to be the lineal descendent of the long, narrow, horizontal retort oven of which the Semet stands out prominently as a type. The Semet ovens were probably first built in 1848 and 1850.

Coppée in a large way, was practically the pioneer in the exploitation of the retort oven, by means of which coals that could not be coked in bee-hive ovens were made available for metallurgical purposes.

The father of Collin, inventor and constructor of the Collin oven built Semet ovens in Germany as early as 1848.

Knab and Carvés used the Semet system in their by-product ovens, but the gas was insufficient for heating the ovens and coal or coke had

to be used as an auxiliary heating agent. This gives some idea of the increased efficiency of the modern by-product oven and of the comparative efficiency of the by-product oven even as late as 1881, when Albert Huessener built his plant at Gelsenkirchen. The Carvés oven originated with Knab, Simon improved this oven and called it the Simon-Carvés.

In 1881, Dr. C. Otto experimented with Coppée ovens at Wattenscheid, Germany, "the heat being supplied entirely by cleaned gas, burning in flues surrounding the coking chamber." As a result, the firm of Dr. C. Otto and Company in 1881 constructed and exploited a form of oven in which the Siemens' Regenerator was employed to recover heat from the waste gases, and to supply heated air combustion, the oven construction being of the Otto Coppée type, and generally known as Otto-Hoffmann oven.

There are differences of opinion as to the relative merits of the horizontal and vertical flued oven that are due mainly to the question of the uniform heating of the sides of the oven. The balance of opinion is in favor of the vertical it would appear.

My observation of the Huessener both at Gelsenkirchen and Middlesbrough satisfy me that for colliery and blast furnace use where surplus gas is not important, it is an oven very well adapted to these uses.

Among vertical flued ovens this may also be said of the Coppée and Otto-Hilgenstock, although Coppée, I understand, has under construction a regenerative oven intended to yield a large gas surplus.

The Otto-Hoffmann, the Koppers and the Collin are the ovens which make substantial claims to producing largest yields of surplus gas and accordingly merit consideration in connection with gas production.

The adherents of Collin and Koppers claim much for their ovens but the claim made for the new Collin oven is that it will give 10 to 15 per cent. more gas and materially shorten the coking period.

Otto-Hoffmann and Collin ovens have regenerators common to all the ovens. Koppers has separate regenerators for each oven.

In the Otto-Hoffmann and Koppers ovens one-half of the oven is heated directly, the other half indirectly. In the directly heated half of the oven the gas is burned at different points along the bottom of the vertical flues, the products of combustion rising in the one-half and descending in the other half of the oven, but heating that to only a moderate degree.

Alternate heating causes different differences of temperature; Collin, proves that one half of such oven is always cooler than the other. In his latest oven which may be built higher than ordinary ovens he has methods for directly heating by contiguous vertical flues continuously from the bottom upward and from the top downward.

I must not forego proper mention of an interesting by-product plant I visited in Bohemia, at Wesseln, near Teplitz, controlled by Imperial Justizrath, Dr. Aufspitzer, whose son in law, Herr Weiss, is the managing director. From the brown coal of that region, a very profitable industry is carried on in the making of coke for domestic purposes—coke of a high grade. The coal has about 35 per cent. of water. All the tar distillates are produced besides aqua ammonia, benzol and gas for power purposes. The domestic coke finds a ready market, at a good price, in the large cities. It is daily shipped. The oven is the improved Appolt; at this plant, the quenching is done without water. Another Appolt plant, for the same company, is being erected near by.

It will be seen that the coke makers copied from the gas makers. But the gas makers have been thinking. The recognition has tardily come that the larger units of the by-product oven, its greater life, the superior yield and quality of its products, especially its superior and varied cokes—domestic, locomotive, general steam raising and metallurgical—should long ago have impressed European gas managers, especially after the excellent paper of Mr. Charles Hunt, now President of the Institution of Gas Engineers, read some 12 years ago before that Institution and the elaborate paper of Dr. F. Schniewind, read before the International Engineering Congress, 1901, so rich in reliable data, diagrams and tables.

Coking is a carbonizing process—so is gas making. The processes in the gas industry of to-day are not as efficient carbonizing agents as those employed in the modern coke industry, and generally speaking, the result per ton of coal carbonized in the by-product oven, of even low gas production, shows a more profitable carbonizing system than does the older diminutive gas retort system.

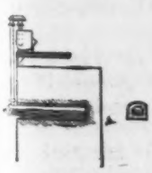


Fig. 6.

The Diminutive Gas Retort.

Some of the foremost gas engineers and financiers of America are interested in gas plants that owe their prosperous condition to the modern by-product oven. It is only fair to meet the objections that have been made by equally reliable authorities in England. They say they want gas—all of the gas. They want to have as little to do with coke as they can help. They may want all the gas, but do not get it. In a recent test made for me in America, it was shown that 25 per cent. less gas than was produced from an exceptionally good gas coal in the by-product ovens was produced in the modern gas retort. The average candle power was also less, and the coke very porous.

A careful calculation shows that if all the gas for heating the ovens were added to the surplus gas, and the ovens were heated with coke or water gas, or by-product producer gas, the result would not be as favorable as if self-generated and automatically fed oven gas were used for heating, provided always that a market could be made for the improved coke.

The economic advantages of the modern by-product oven were so wellrecognized years ago, as I have already stated, in America, that ovens were built near Boston in which coke is made, and all, the gas to illuminate Boston and surrounding towns is manufactured. At Camden, N. J., some 20 towns are supplied with gas by the Camden Coke Company, controlled by the Public Service Corporation of New Jersey, gas being piped as far as Trenton, a distance of some 40 miles. The gas for the city of Baltimore is made almost entirely in by-product ovens, and piped from the coke works at Sparrow's Point. Both in Boston and Camden the exploitation of by-product coke has been very successful for domestic, steam raising and metallurgical purposes. It has displaced anthracite coal to a considerable extent in many places, and is used successfully on locomotives and as a competitor of bee-hive oven coke.

(To be Continued.)

Gas Light Globe Signs.

[Communicated by ENGINEER.]

The sign makers are using gas light globes quite liberally in the presentation of advertisements. The plan consists in cutting the sign on the glass globe with emery, or by placing it there with some kind of coloring matter. The employment of gas arcs for this purpose has been undertaken with considerable success. The sign globes are not only used for purposes of advertising, but for enumerating numbers of houses, names of streets, etc. However, the employment of the inscribed globes for purposes of advertising opens a new field. In many places where gas is available exterior arc lights are utilized for purposes of lighting show windows of stores. The lamps are arranged outside where the show window is not only lighted but the sidewalk and street in front as well. The plan of using inscriptions on the globes involves the use of these exterior gas arcs; hence the globes employed essentially for lighting purposes can be made use of for advertising.

Quite an industry has been opened up in many cities and towns along this line. The work involves, first of all, the inscribing of the notice on the globe. I visited some of the shops where this work is done. The agent of the works usually calls upon proprietors of stores and shops where he observes lamp globes available for this purpose and arranges to inscribe on the globes, reflectors and shades the necessary lines of advertising matter.

The proper design is executed and the letters necessary in the formation of the inscriptions are put on. If the letters are engraved or cut in imitation work the emery wheel is used. The buffing-wheel and cross-grinder come into service. The cutting of the glass is rather more expensive than many of the advertisers can afford, therefore the greater percentage of signs are inscribed on the globes in paint. The jet black paint will always give forth a good, solid letter. The inscription may be put on as illustrated on the shade in Fig. 1. Instead of the line "Signs" any term may be used. "Boots and Shoes," "Groceries," in fact any line of goods may be set forth before the public this way. The painted globe is always more readily altered, but if you get your advertisement cut into the glass you cannot have it changed.

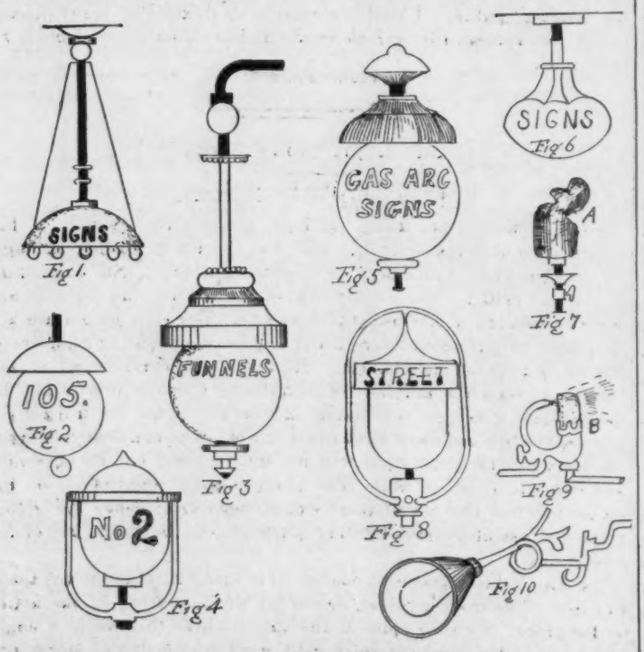
Some of the stores that employ this mode of advertising arrange for weekly alterations of the signs on the globes, and stores carrying various stocks of goods can in this manner call attention to different styles of goods during the month. The painted sign is readily effaced and the smooth surface made ready for a new application.

Fig. 2 illustrates the common, numbered globe. I notice that many of the house numbers of edifices are arranged in this way in cities and towns. It is very convenient to locate a residence at night when the number stands out plainly on the globe in front of the entrance, for it

saves the trouble of going up to the door and striking a match. In some cities and large towns the practice of using front lights for indicating the number of the house is very common. In other cities I find it quite the style for the man of the house to have his name on a globe, out in front, which is something exceedingly useful and practicable. Night lamps have been introduced, with good results, in halls and at entrances to halls and doors, in some of the best sections of our largest cities. Of course the lights within the globes on these night lamps need not be very powerful. Not very much gas is consumed, and on dark nights such lights are exceedingly useful, in that they often prevent accidents by lighting up diffic lt stairways and arched entrances.

The type of lamp exhibited in Fig. 3 is a gas arc intended for placing outside to advertise certain wares. Perhaps a line of tinware is to be put out; in fact any description of goods may be referred to on the globe. The bright light within reflects through the line of letters and the letters are plainly observable from the outside; as above stated, such a light also serves to light up the front of the store. Another form of the light as used for this purpose is shown in Fig. 4. Lamps in mines are used in this style, with numbers of sections, designating the way to the workmen in the dark channels. Exits in theaters come under this head. The globe is sometimes colored and the sign subdued; but when it is desired that the light be diffused about the premises the white globes are used.

A great many gas arc signs are used in modern department stores,



even through the daytime, especially in basement apartments or where the window light is bad. These gas arcs are usually made on the plan familiar to all, and are set up on brackets with the globes properly worded, as in Fig. 5. However, in practice the department store gas arc globes would be printed with signs denoting the number of the department and the kind of goods carried there. The boot and shoe department, or the candy or book departments would have their respective globes, hence people would be able to find the locations more readily. Many of the globes are small in size and arranged as in Fig. 6. Some of them which are exceedingly small are for an especial purpose. The mantle is used in many of the gas arcs, and as long as the mantle is kept in condition a bright light results. I find that defective lighting arises in many of the store and street lamps due to the partial bending, collapsing or breaking of the mantles, as shown at *A*, Fig. 7. In some cities inspectors are in charge of the gas arcs in a series of stores, and these men as a rule are careful about keeping the mantles in shape. As soon as a mantle breaks down a new one is substituted; but this system of inspection does not prevail everywhere, consequently one can find numerous cases of defective lights due to poorly conditioned mantles.

Fig. 8 shows a popular style of gas arc for giving the name of the street. Such lights are usually in the care of the city and are well conditioned. Fig. 9 is one of the combinations used for getting an exceedingly bright light on a lime. The lime is marked *B*, and hydrogen and oxygen gas are burned on the lime, creating an intensely white light. This light is taken through condensers on to movable signs in a steel frame, and serves to set forth the signs advertising the goods of the store and to light up the store front in good form. Sometimes the interior of the shade of the light is used for advertising. In Fig. 10 it will be seen that there is a clear space inside the shade. This space offers room for placing a word, number or character.

A Cincinnati Method of Advertising Gas.

The new management in the Cincinnati Gas and Electric Company leaves no chance that promised results go untried in planning for increasing the use of gas on domestic account in that city. Just now the educational method is being followed with persistency and with success. In the canvass the use of photographs, singles or groups, plays a prominent part, and the groupings are from "real life-work." One of the many is shown in the accompanying cut, which was taken in

Teaching the "Young Idea" in a Novel Way.

the domestic science department of one of the large public schools of Cincinnati, and its story is so plainly told in the picture that further description is wholly unnecessary. It should be added that the photos are frequently reproduced in the Company's ads. as printed in the Cincinnati dailies.

[Concluded from page 972.]

Steam in Gas Producer Practice.—An Investigation on the Use of Steam in Gas Producer Practice.[1]

By W. A. Bone, D.Sc., Ph.D., F.R.S., Professor of Applied Chemistry (Fuel and Metallurgy), Leeds University; and R. V. Wheeler, M.Sc., late Dalton Scholar and Research Fellow of Manchester University; Chemist to Messrs. Monks, Hall & Co., Ltd, Warrington, England.

General Arrangement for the Trials.—The trials were conducted under our personal supervision, with the assistance of a foreman and a staff of 4 workmen, to each of whom certain definite duties were assigned. Each trial extended over a full working week, and nothing was done or attempted to interfere with the regular supply of gas to the various furnaces and engines, which were worked throughout each week under perfectly normal conditions. It may, therefore, be taken for granted that the conditions prevailing throughout the whole period covered by the trials were such as are ordinarily met with in works' practice.

The only condition which was purposely varied during the trials was the steam saturation temperature of the air blast at the producer. Beginning with a "saturation temperature" of 60° C., it was raised, week by week, in stages of 5° up to 80° C., which represents the ordinary

1. Paper read before the Iron and Steel Institute, May 10, 1907.

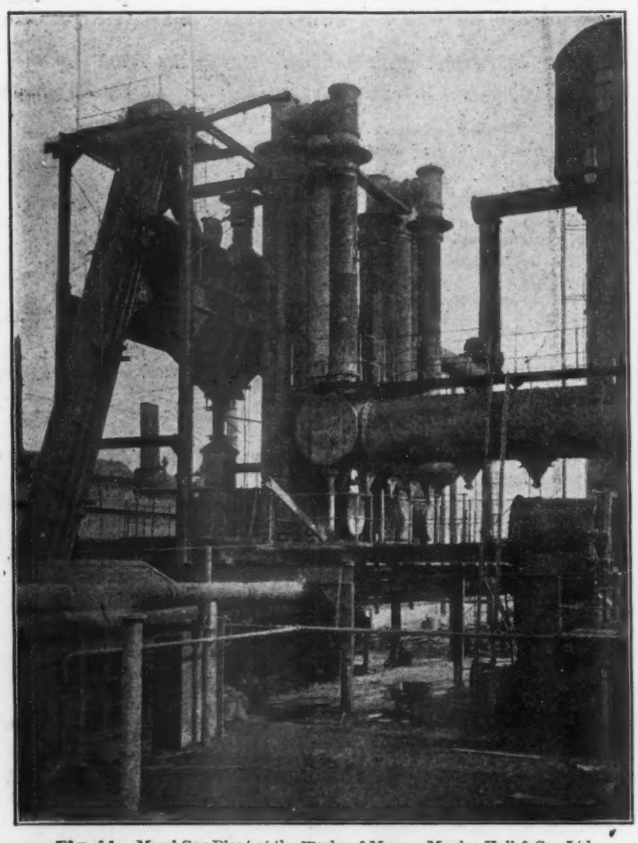


Fig. 11.—Mond Gas Plant at the Works of Messrs. Monks, Hall & Co., Ltd.

Mond practice where ammonia recovery is not attempted. Suitable arrangements were made for (1) the weighing of the whole of the coal charged into the producer, as well as that burned under the boiler, throughout each trial; (2) the continuous sampling of the gas over a period of 8 hours during each day shift, each sample, therefore, representing the mean composition of the gas generated in one day; (3) the daily estimation of ammonia, tar vapor and sulphur compounds in the gas; (4) the weekly collection and weighing of the tar deposited throughout the plant during each trial; (5) the weighing of the dried ashes, clinker and coke withdrawn from the water troughs at the bottom of each producer; and (6) the estimation of the amount of soot and fine ash carried over by the gas and deposited in the mains during each trial.

The samples of coal, tar, ashes, soot, gas, etc., were afterwards submitted to careful analysis. The gas analyses were all carried out over mercury in the special apparatus designed for research purposes,[1] and erected in the chemical laboratories at the Owens College, Manchester. The calorific values of the producer coal, boiler fuel and tar were all determined in a Berthelot-Mahler bomb calorimeter.

From the analytical data were calculated:

1. The total carbon in a ton of dry coal charged into the producer.
2. The proportions of this carbon lost in the tar, ashes and soot.
3. The proportion of the carbon actually gasified.
4. The weight of carbon in a cubic foot of the gas.
5. The yield of gas per ton of coal gasified.
6. The calorific value of the gas per cubic foot at 0° C. and 760 millimeters.

Determination of Efficiency.—There is as yet no general agreement among chemists and gas engineers as to the precise definition of "efficiency" as applied to producer plants. In catalogues and descriptions published by or in the interests of the makers of gas plants, the ratio between the gross calorific values of the coal actually gasified in the producer and of the gas obtained therefrom is often quoted as the efficiency of the plant. Such statements are, of course, quite misleading. In our opinion, the efficiency of a gas producing plant should have reference to the gas as delivered to the furnace main or the engines, and should be based on the net calorific values of the coal and gas respectively. It should include the coal burnt under the boiler for raising steam for the blast, plus that required for the blower engine; and also, where it is necessary to cool and wash the gas for engines, it should include the coal equivalent of the mechanical work required for the washing. The efficiency would then represent the ratio of the available energy of the gas, as supplied to the furnace or engine, to the energy of the coal required to produce it.

In the case of the trials under discussion, the gas was both washed and cooled before delivery to either engines or furnaces, although the engine supply was more thoroughly cooled and scrubbed than the furnace supply. Moreover, in the case of the two trials with steam saturation temperatures of 60° and 65° respectively, it was found possible to work the producers with exhaust steam entirely, but in the other trials it was necessary to add live steam to the blast.

The boiler used for supplying steam for the gas plant evaporated 8 pounds of water, from and at 100° C., for every 1 pound of dry coal, of net calorific value 3,368 kilogramme C. units, burnt under it. This corresponds to a boiler efficiency of 58 per cent. only. As it would obviously be unfair to saddle the producer plant with the shortcomings of the boiler, we have, in calculating the various efficiency ratios, assumed a boiler efficiency of 70 per cent. In other words, the figures quoted in the tables for fuel consumed at the boiler are, in each case, the actual consumptions multiplied by $\frac{5}{7}^{8} = 0.83$.

The steam required for mechanical work on the plant corresponded to an average coal consumption at the boiler of as nearly as possible 2 cwt. per hour during the trials, calculated on the basis of a 70-per cent. boiler efficiency. Of this, 0.5 cwt. was required to provide steam for the blowing engine, the remaining 1.5 cwt. represented the coal equivalent to the work done during the washing of the gas.

In the case of each of the 5 trials we have calculated 3 different sets of efficiency ratios, all for the cold and completely washed gas, as delivered to the engines, and all based on the net calorific value of both gas and coal, as follows:

z_1 = Thermal efficiency of the plant, under the actual conditions of the respective trials, the higher value including the steam required for the blower engine, the lower value including the steam required both for the blower engine and the washing plant.

z_2 = A similar pair of values, but calculated on the assumption that the whole of the steam added to the blast was live steam from a boiler with a 70-per cent. efficiency.

z_3 = A third pair of values, but calculated on the assumption that the whole of the steam added to the blast was exhaust steam.

We have also been able to deduce from our results what proportions of the oxygen present in the gas, as oxides of carbon, were derived from the steam and air respectively, in the blast, and also what proportion of the steam was actually decomposed in the producer throughout each trial. All these figures, together with other information as to the quantities of ammonia and sulphur compounds present in the gas, will be included in the results of each trial, which will now be considered in detail.

Analysis and Calorific Value of the Coal Used During the Trials.

The coal used during the trials was "Collins' green washed nuts" from the Florida seam of the Collins' Green and Bold Collieries, near Earlestown, Lancashire. It was screened over a 1-inch mesh, and as delivered to the producer it contained from 3 to 6 per cent. moisture.

The following table shows the results of analyses of composite samples of the coal (dried at 105° C.) taken during each of the five weeks over which the trials extended.

Week Ending	May 19.. Per Cent.	May 26. Per Cent.	June 2. Per Cent.	June 16. Per Cent.	June 23. Per Cent.	Mean. P. C.
Carbon	78.63	78.65	78.06	78.80	77.90	78.41
Hydrogen	5.18	5.37	5.22	6.50	5.30	5.51
Nitrogen	1.37	1.39	1.37	1.40	1.40	1.39*
Sulpher	0.84	0.82	0.86	0.83	0.80	0.83
Oxygen(by difference)	10.98	10.77	10.39	8.72	9.30	10.03
Ash	3.00	3.00	4.10	3.75	5.30	3.83
Per cent. volatile matter	36.4	35.9	36.1	37.6	35.1	36.2

* This nitrogen, if wholly recovered as ammonia, would correspond to a yield of 147 pounds of ammonium sulphate per ton of coal.

The mean calorific value of the dry coal was

Gross value = 3,498 kilog. cent. units = 13,880 B.T.U.
Net value = 3,362 " " " = 13,340 " } per pound.

[1] W. A. Bone, Proceedings of the Chemical Society, 1898, Vol. XIV., p. 174.

TRIAL No. 1.—*Steam Saturation Temperature = 60° C.—Monday, May 14, 9:10 P.M., to Saturday, May 19, 1906, 12:45 P.M.*

Average barometer = 754 millimeters.
Average blast pressure = 7.5 centimeters (day shift) and 2.3 centimeters (night shift) water gauge.
Partial pressures in blast { H_2O = 150 mm. / O_2 = 128 " / N_2 = 482 "
Total dry coal charged into producer = 92 tons 1 cwt. = 162,100 pounds of carbon.
Average rate of gasification = 16.51 cwt. per hour.
Consumption of coal at the boiler = 2.0 cwt. per hour (0.5 cwt. for blower engine; 1.5 cwt. for washers).

The steam in the blast was wholly exhaust steam throughout the trial.

Estimation of Carbon Losses During the Trial.

Total carbon charged into producer.....162,100 pounds.

	Cwt.	Qr.	Lbs.	Per Cent. Carbon.	Equivalent to Pounds Carbon.	
Ashes drawn.....	9	0	13	28.0	286	
Clinker drawn.....	11	1	13	0.08	1	
Coke drawn.....	20	0	14	70.55	1,590	
Soot in mains.....	1	2	14	85.0	155	
Anhydrous tar removed by washing.....	44	1	17	83.1	7,390	
Anhydrous tar remaining in gas..	35	0	0		——	9,422 pounds.

Total carbon gasified..... { 152,678 pounds. / = 94.2 per cent.

Total ammonia in gas was equivalent to 39 pounds ammonium sulphate per ton of coal gasified.

Total sulphur in the gas = 0.00185 gramme per liter = 808 grains per 1,000 cubic feet (chiefly as sulphuretted hydrogen).

The percentage composition of the gas obtained during each day of the trial was as follows:

Week Ending	May 15. Per Cent.	May 16. Per Cent.	May 17. Per Cent.	May 18. Per Cent.	May 19. Per Cent.	Mean. Per Cent.
Carbon dioxide....	5.0	5.1	5.9	5.25	5.05	5.25
Carbon monoxide..	27.6	27.8	26.45	27.20	27.50	27.30
Hydrogen.....	16.2	17.0	16.8	16.85	16.10	16.60
Methane.....	3.7	3.0	3.15	2.70	4.25	3.35
Nitrogen	47.5	47.1	47.7	48.0	47.10	47.50
Total combustibles.	47.5	47.8	46.4	46.75	47.85	47.25

Yield of gas = 138,250 cubic feet, at 0° C., and 760 millimeters, per ton of dry coal gasified in the producer.

Mean calorific value of the gas..... = { 46.77 gross / 43.60 net } kilog. cent. units per cubic foot at 0° C. and 760 mm.
Steam used in blast = 0.455 pound per pound of coal gasified.
Air " " = 36.95 cubic feet, at 0° C. and 760 millimeters, per pound of coal gasified.
Percentage of steam decomposed in the producer = 87.4.

$$\text{Ratio of } \frac{\text{oxygen in gas derived from the steam}}{\text{oxygen in gas derived from the air}} = 0.5$$

Efficiency Ratios.

	Including Steam for Blower Engine.	Including Steam for Blower Engine and Washers.
z_1.....	0.778	0.715
z_2.....	0.744	0.687
z_3.....	0.778	0.715

TRIAL No. 2.—*Steam Saturation Temperature = 65° C.—Monday, June 18, 9 P.M., to Saturday, June 23, 1906, 1 P.M.*

Average barometer = 767 mm.
Average blast pressure = 9 cm. (day shift) and 3 cm. (night shift) water gauge.
Partial pressures in blast { H_2O = 187 mm. / O_2 = 123 " / N_2 = 465 "
Total dry coal charged into producer = 79 tons 17 cwt. = 139,300 pounds of carbon.
Average rate of gasification = 14.26 cwt. per hour.
Consumption of coal at the boiler = 1.80 cwt. per hour (0.45 cwt. for blower engine; 1.35 cwt. for washers).

The steam in the blast was wholly exhaust steam throughout the trial.

Estimation of Carbon Losses During the Trial.

Total carbon charged into producer.....139,300 pounds.

	Cwt.	Qr.	Lbs.	Per Cent. Carbon.	Equivalent to Pounds Carbon.	
Ashes drawn.....	27	1	5	14.25	432	
Clinker drawn	27	0	25	0.25	8	
Coke drawn.....	9	3	3	95.4	1,035	
Soot in mains	1	1	4	85	122	
Anhydrous tar removed by washing	36	3	19	83.1	9,200	
Anhydrous tar remaining in gas..	63	0	0		——	10,797 pounds.

Total carbon gasified..... { 128,503 pounds. / = 92.2 per cent.

Total ammonia in gas was equivalent to 44.7 pounds ammonium sulphate per ton of coal gasified.

Total sulphur in gas = 0.00193 gramme per liter = 843 grains per 1,000 cubic feet.

The percentage composition of the gas obtained during each day of the trial was as follows:

Week Ending.	June 19. Per Cent.	June 20. Per Cent.	June 21. Per Cent.	Mean. Per Cent.
Carbon dioxide..	7.05	6.35	7.4	6.9
Carbon monoxide.....	25.85	25.90	24.4	25.4
Hydrogen.	18.05	18.05	18.2	18.3
Methane.....	3.10	3.55	3.5	3.4
Nitrogen.....	45.35	46.15	46.5	46
Total combustibles...	47.6	47.5	46.1	47.1

Yield of gas = 134,400 cubic feet, at 0° C. and 760 millimeters, per ton of dry coal gasified in the producer.

Mean calorific value of the gas = { 46.74 gross.... / 43.32 net..... } kilogramme cent. units per cubic foot at 0° C. and 760 millimeters.

Steam used in blast = 0.544 pounds per pound of coal gasified.
Air used in blast = 34.9 cubic feet, at 0° C. and 760 millimeters, per pound of coal gasified.
Percentage of steam decomposed in the producer = 80.

$$\text{Ratio of } \frac{\text{oxygen in gas derived from the steam}}{\text{oxygen in gas derived from the air}} = 0.62.$$

Efficiency Ratios.

	Including Steam for Blower Engine.	Including Steam for Blower Engine and Washers.
z_1.....	0.750	0.687
z_2.....	0.711	0.655
z_3.....	0.750	0.687

TRIAL No. 3.—*Steam Saturation Temperature = 70° C., Sunday, May 20, 10:40 P.M., to Saturday, May 26, 1906, 12:50 P.M.*

Average barometer = 757 millimeters.
Average blast pressure = 10 centimeters (day shift) and 3 centimeters (night shift) water gauge.
Partial pressures in blast { H_2O = 233 millimeters. / O_2 = 111 " / N_2 = 420 "
Total dry coal charged into producer = 93 tons = 163,850 pounds of carbon.
Average rate of gasification = 13.88 cwt. per hour.
Consumption of coal at the boiler = 2.38 cwt. per hour (0.50 cwt. for blower engine; 1.50 cwt. for washers; 0.38 cwt. for blast steam).

About 68 per cent. of the steam used for the blast was exhaust steam.

Estimation of Carbon Losses During the Trial.

Total carbon charged into producer .....163,850 pounds.

	Cwt.	Qr.	Lbs.	Per Cent. Carbon.	Equivalent to Pounds Carbon.	
Ashes drawn.....	10	2	16	46.5	555	
Clinker drawn.....	14	2	26	0.3	5	
Coke drawn.....	20	1	19	91.2	2,085	
Soot in mains.....	2	2	18	80	238	
Anhydrous tar removed by washing.....	68	0	0	83.1	10,470	
Anhydrous tar remaining in gas ..	44	2	0		——	13,353 pounds.

Total carbon gasified..... { 150,497 pounds. / = 91.90 per cent.

Total ammonia in gas was equivalent to 51.42 pounds of ammonium sulphate per ton of coal gasified.

Total sulphur in gas = 0.00178 gramme per liter = 777 grains per 1,000 cubic feet at 0° C. and 760 millimeters.

The percentage composition of the gas obtained during each day of the trial was as follows:

Week Ending.	May 21. P. C.	May 22. P. C.	May 23. P. C.	May 24. P. C.	May 25. P. C.	May 26. P. C.	Mean. P. C.
Carbon dioxide.....	9.35	10.0	9.00	8.80	8.70	9.15	9.15
Carbon monoxide..	21.15	20.1	24.75	22.75	22.05	22.10	21.70
Hydrogen	20.30	19.0	19.15	19 50	19.40	20.50	19.65
Methane.....	2.75	3.7	3.85	3 25	3.60	3.25	3.40
Nitrogen	46.10	47.2	46 25	45.70	46.25	45.00	46.10
Total combustibles.	44 45	42.8	44.75	45 5	45.05	45.85	44.75

Yield of gas = 141,450 cubic feet, at 0° C. and 760 millimeters, per ton of dry coal gasified in the producer.

Mean calorific value of the gas = { 44.74 gross.... / 41.14 net..... } kilog. cent. units per cubic foot at 0° C. and 760 millimeters.

Steam used in blast = 0.81 pound per pound of coal gasified.

Air used in blast = 36.8 cubic feet at 0° C. and 760 millimeters, per pound of coal gasified.

Percentage of steam decomposed in producer = 61.4.

$$\text{Ratio of } \frac{\text{oxygen in gas derived from the steam}}{\text{oxygen in gas derived from the air}} = 0.644$$

Efficiency Ratios.

	Including Steam for Blower Engine.	Including Steam for Blower Engine and Washers.
z_1.....	0.727	0.660
z_2.....	0.690	0.63
z_3.....	0.746	0.677

TRIAL No. 4.—*Steam Saturation Temperature = 75° C. Monday, May 28, 8:45 P. M., to Saturday, June 2, 1906, 1 P. M.*

Average barometer.... = 755 millimeters.

Average blast pressure. = 11.3 centimeters (day-shift) and 3 5 centimeters (night-shift) water gauge.

Partial pressures in blast.... { H_2O = 288 millimeters. / O_2 = 99 " / N_2 = 376 " }

Total dry coal charged into producer = 80 tons 4 cwt. = 140,000 pounds of carbon.

Average rate of gasification..... = 14.32 cwt. per hour.

Consumption of coal at the boiler. = 2.87 cwt. per hour (0.50 cwt. for blower engine; 1.50 cwt. for washers; 0.87 cwt. for blast steam).

About 54 per cent. of the steam used for the blast was exhaust steam.

Estimation of Carbon Losses During the Trial.

Total carbon charged into producer.....140,300 pounds.

	Cwt.	Qr.	Lb.	Per Cent. Carbon.	Equivalent to Pound Carbon.	
Ashes drawn.....	17	1	21	20.1	400	
Clinker drawn.....	19	2	0	0.7	14	
Coke drawn.....	12	3	11	91.1	1,310	
Soot in mains.....	2	1	2	80.0	205	
Anhydrous tar removed by washing.	40	2	0	83.1	8,230	
Anhydrous tar remaining in gas....	48	0	0			10,159 pounds.

Total carbon gasified { 130,141 pounds = 92.75 per cent.

Total ammonia in gas was equivalent to 65.25 pounds of ammonium sulphate per ton of coal gasified.

The percentage composition of the gas obtained during each day of the trial was as follows:

Week Ending	May 29. Per Cent.	May 30. Per Cent.	May 31. Per Cent.	June 1. Per Cent.	Mean. Per Cent.
Carbon dioxide.....	11,65	11.45	11.95	11.60	11.65
Carbon monoxide....	18.25	18.40	18 15	18.60	18.35
Hydrogen.....	20.60	21.75	21.80	23.0	21.80
Methane.....	3.20	3.65	3.60	2.90	3.35
Nitrogen.....	46.30	44.75	44.50	43.90	44.95
Total combustibles.	42.05	43.80	43.55	44.5	43.5

Yield of gas = 145,600 cubic feet, at 0° C. and 760 millimeters, per ton of dry coal gasified in the producer.

Mean calorific value of the gas = { 43.57 gross / 39.65 net } kilog. cent. units per cubic feet at 0° C. and 760 millimeters.

Steam used in blast = 1.12 pounds per pound of coal gasified.

Air used in blast = 36.9 cubic feet, at 0° C. and 760 millimeters, per pound of coal gasified.

Percentage of steam decomposed in the producer = 52.

$$\text{Ratio of } \frac{\text{oxygen in gas derived from the steam}}{\text{oxygen in gas derived from the air}} = 0.75$$

Efficiency Ratios.

	Including Steam for Blower Engine.	Including Steam for Blower Engine and Washers.
z_1.....	0.701	0.640
z_2.....	0.667	0.611
z_3.....	0.742	0.673

TRIAL No. 5.—*Steam Saturation Temperature = 80° C. Monday, June 11, 9:30 P. M., to Saturday, June 16, 12:50 P. M.*

Average barometer..... = 766 millimeters.

Average blast pressure..... = 13.9 centimeters (day shift) and 5 5 centimeters (night shift) water gauge.

Partial pressure in blast..... { H_2O = 355 millimeters. / O_2 = 88 " / N_2 = 333 " }

Total dry coal charged into producer = 74 tons = 130,650 pounds of carbon.

Average rate of gasification..... = 13.21 cwt. per hour,

Consumption of coal at the boiler.... = 3.35 cwt. per hour (0 50 cwt. for blower engine; 1.50 cwt. for washers; 1.35 cwt. for blast steam).

About 38 per cent. of the steam used for the blast was exhaust steam.

Estimation of Carbon Losses During the Trial.

Total carbon charged into producer..... 130,650 pounds.

	Cwt.	Qr.	Lb.	Per Cent. Carbon.	Equivalent to Pound Carbon.	
Ashes drawn.....	28	0	0	12.35	387	
Clinker drawn.....	25	1	14	0.65	18	
Coke drawn.....	7	0	5	83.6	660	
Soot in mains.....		3	10	85.0	365	
Anhydrous tar removed by washing.	42	1	18	83.1	9,530	
Anhydrous tar remaining in gas....	60	0	0			10,960 pounds

Total carbon gasified { 119,690 pounds = 91.6 per cent.

Total ammonia in gas was equivalent to 71.80 pounds of ammonium sulphate per ton of coal gasified in the producer.

Total sulphur in gas = 0.00199 gramme per liter = 869 grains per 1,000 cubic feet.

The percentage composition of the gas obtained during each day of the trial was as follows:

Week Ending	June 13. Per Cent.	June 14. Per Cent.	June 15. Per Cent.	Mean. Per Cent.
Carbon dioxide.....	13.05	13 20	13.45	13.25
Carbon monoxide....	16.20	16.15	15.85	16.10
Hydrogen.....	22.95	22.50	22.55	22 65
Methane.....	3.40	3.50	3.60	3.50
Nitrogen.	44.40	44.65	44.55	44.50
Total combustibles..	42.55	42.15	42.00	42.25

Yield of gas = 147,500 cubic feet, at 0° C. and 760 millimeters, per ton of dry coal gasified in the producer.

Mean calorific value of the gas = { 42.73 gross..... / 38.69 net..... } kilogramme cent. units per cubic foot at 0° C. and 760 millimeters.

Steam used in blast = 1.57 pound per pound of coal gasified.

Air used in blast = 37.1 cubic feet, at 0° C. and 760 millimeters, per pound of coal gasified.

Percentage of steam decomposed in the producer = 40.

$$\text{Ratio of } \frac{\text{oxygen in gas derived from the steam}}{\text{oxygen in gas derived from the air}} = 0.80$$

Efficieney Ratios.

	Including Steam for Blower Engine.	Including Steam for Blower Engine and Washers.
z_1.....	0.665	0.604
z_2.....	0.633	0.578
z_3.....	0.732	0.660

General Summary of Results and Conclusions.

The principal results of the 5 trials may be summarized in one table, thus:

Steam Saturation Temperature.	60°	65°	70°	75°	80°
Coal consumption at producer cwts. per hour	16.51	14.26	13.88	14 32	13.21
Coal consumption at boiler, cwts. per hour	2.0	1.8	2.38	2.87	3.35
Coal consumption for blast steam	Nil	Nil	0.38	0.87	1.35
Total carbon losses per cent.	5.8	7.8	8.1	7.1	8 4
Mean percentage composition of gas obtained. Carbon dioxide	5 25	6 95	9.15	11.65	13 25
Carbon monoxide	27.30	25.40	21.70	18 35	16.05
Hydrogen	16.60	18 30	19 65	21.80	22 65
Methane	3.35	3 40	3.40	3.35	3 50
Nitrogen	47.50	45 90	46.10	44 83	44.55
Total combustibles	47.25	47.10	44.75	43.50	42.20
Calorific value of gas (Kilog. cent. units per cubic feet at 0° C. and 700 mm.) gross	46.77	46.74	44 74	43 37	42.73
net	43.60	43.32	41.14	39.65	38.69
Yield of gas, cubic feet per ton	138,250	134,400	141,450	145,800	147,500
Pounds of steam in blast per pound of coal gasified	0.45	0.55	0.80	1.10	1.55
Percentage of steam decomposed	87.4	80.0	61.4	52.0	40.0
Cubic feet of air, at 0° C. and 760 mm., in blast per pound of coal gasified	36.95	34.9	36.8	36.9	37.1
Ratio of oxygen from steam	0.50	0.62	0 65	0.75	0.80
Ratio of oxygen from air	0.50	0.62	0.65	0.75	0.80
Ammonia in gas, at pounds of ammonium sulphate per ton of coal	39.0	44.7	51 4	65.25	71.8
Efficiency ratios in actual trial:					
1. Including steam for blower engine	0.778	0.750	0.727	0.701	0.665
2. Including steam for blower engine and washers	0 715	0.687	0 660	0.640	0.601

The average pressures under the grate of the producers, and the temperatures of the gas (1) as it left the superheaters, and (2) in the furnace main, for both day and night shifts throughout the trials, are shown in Figs. 6, 7 and 8 (*ante*, p. 932).

General Conclusions.

1. *Quality and Composition of the Gas.*—A glance at the summarized results in the foregoing table will show that the quality of the gas obtained, though always good, steadily deteriorated as the steam saturation temperature was raised beyond 65°. Thus, whereas at 60° and 65° the average percentage of total combustibles in the gas exceeded what must be considered the high figure of 47 per cent., it steadily dropped to about 42 per cent. as the steam saturation temperature was raised to 80°. This falling off in quality was, it is true, partly counterbalanced by an increase in the quantity produced per ton of coal gasified; but, as will be shown immediately, the general efficiency of the process fell off as more steam was used. But the advantages gained by working at the lower steam saturation temperatures become more marked when the composition of the gas is taken into account. It will be seen that as the steam saturation temperature was raised the gas became richer in hydrogen and carbon dioxide, but much poorer in carbon monoxide, and that the gain in hydrogen was more than counterbalanced by the loss in carbonic oxide. This circumstance is, of course, due to the influence of the steam in lowering the reaction temperatures in the zone of combustion, whereby the reaction $C + 2OH_2 = CO_2 + 2H_2$ comes into play at the expense of the reaction $C + OH_2 = CO + H_2$, and the equilibrium $CO + OH_2 \rightleftarrows CO_2 + H_2$ shifts towards the right hand. This influence naturally increases as the steam saturation temperature is raised, with the result that the quality and composition of the gas alter as shown by our results. With a steam saturation temperature of 60°, the resulting gas contained no less than 27.3 per cent. of carbon monoxide, together with 16.6 per cent. of hydrogen, 3.35 per cent. of methane, and only 5 25 per cent. of carbon dioxide. But with a saturation temperature of 80°, the percentage of carbonic oxide had fallen to 16.05, whilst the hydrogen had increased to 22 65 per cent. and the carbon dioxide to 13.25 per cent., the methane remaining practically constant throughout the trials. The net calorific value of the gas gradually fell from 43.60 to 38.69 kilogramme C. units per cubic foot, at 0° C. and 760 millimeters, as the steam saturation temperature was raised.

Now, as we have already pointed out, the "furnace efficiency" of carbon monoxide is much higher than that of hydrogen, and that consequently the furnace efficiency of a producer gas rich in carbon monoxide is higher than that of a gas of equal calorific value, but in which carbon monoxide is partly replaced by hydrogen. The reasons for this we do propose to discuss in detail in this paper, as it is sufficient for our present purpose to draw attention to the fact itself. Hence we were not surprised to find that the value of the gas obtained with steam saturation temperatures of 60° and 65°, from the point of view of its combustion in the furnace, was greater than that of the gas obtained in any of the other trials to an extent altogether out of proportion to its actual superiority as measured in a calorimeter. In other words, the difference between the two net calorific values 43.60° and 38 69° per cubic foot, for the gases obtained with steam saturation temperatures of 60° and 80° respectively, are magnified when their "furnace efficiencies" are taken into consideration.

2. *Thermal Efficiencies of the Plant.*—If now the thermal efficiencies of the plant be considered, it will be seen at once that the use of steam beyond that required to saturate the air blast at 60° was not attended by any increased economy of working, but rather the reverse. If, in calculating the thermal efficiencies in the various trials, account be taken of the steam added to the blast, and the work expended in driving the blower and the washers, the following values are obtained—namely, z_1 under the actual conditions of the trial, z_2 on the assumption that the blast steam was wholly live steam from a boiler with a 70 per cent. efficiency, and z_3 on the assumption that the whole of the blast steam was exhaust steam:

Steam Saturation Temperature.	60°	65°	70°	75°	80°
z_1	0.715	0.687	0.660	0.640	0.604
z_2	0.687	0.655	0.630	0.611	0.578
z_3	0.715	0.687	0 677	0.673	0.660

Under the conditions of the trial, therefore, the thermal efficiency of the plant fell from 71.5 to 60.4 per cent. as the steam saturation temperature was raised from 60° to 80°. If, however, live steam only had been used for the blast, the corresponding fall would have been from 68.7 to 57.8 per cent. And even if it had been possible to saturate the air blast with exhaust steam entirely throughout the trials, the efficiency would have fallen from 71.5 to 66 per cent. Hence it is clearly proved that the use of steam over and above that required to saturate the blast at 60° does not lead to higher thermal efficiencies.

The question may be asked: Would the efficiency have been raised above 71.5 per cent. if the steam saturation temperature had been lowered beyond 60°? Possibly, and, indeed, probably, it would have been; but we were precluded from making the trial for fear of clinkering troubles arising with so deep a bed of fuel. It is our intention, however, to make a series of trials with steam saturation temperatures lower than 60°, but with a much shallower fuel bed than was used in the above trials. In our opinion, the maximum of advantage derivable from the use of steam depends to some extent on the thickness of the fuel bed; but under such working conditions as were maintained in the above trials, this maximum is probably attained with a steam saturation temperature between 60° and 65°, taking all the factors into consideration.

3. *Amounts of Steam Used and Decomposed in the Trials.*—The amounts of steam used and decomposed in the producer during the trials, in terms of pounds per pounds of dry coal gasified, are recorded below:

Steam Saturation Temperature.	60°	65°	70°	75°	80°
Steam used, pound	0.45	0.55	0.80	1 10	1.55
Steam decomposed, pound	0.39	0 44	0.49	0.57	0.62
Per cent. steam decomposed	87.4	80	61.4	52	42

4. *Yields of Ammonia.*—If a gas producer be regarded primarily as an apparatus for ammonia recovery, then undoubtedly it should be worked with the highest steam saturation temperature consistent with the production of combustible gas. The ammonium sulphate equivalent of the ammonia in the gas during the trials increased from 39 pounds to about 72 pounds per ton of dry coal gasified, as the steam saturation temperature of the blast was raised from 60° to 80°. Now the nitrogen in the original coal corresponded to an average of 147 pounds of ammonium sulphate per ton, so that with a steam saturation temperature of 80° nearly 50 per cent. of the nitrogen in the coal is

accounted for as ammonia in the gas, and even with a saturation temperature of 60° as much as 27 per cent. of the ammonia can be recovered. Probably the best steam saturation temperature, if ammonia recovery be considered in conjunction with the suitability of the gas for furnace purposes and the thermal efficiency of the process, is somewhere in the neighborhood of 65°, or possibly between 65° and 70°. At 65° over 30 per cent. of the nitrogen in the coal can be recovered as ammonia, or nearly double the amount usually recovered in by-product coking processes, in conjunction with a very suitable gas for furnace purposes.

5. *Tar Production and Carbon Losses Generally.*—Altogether 419 tons of coal, containing 736,200 pounds of carbon, were charged into the producer during the course of the trials. The amount of anhydrous tar obtained, including both that removed in the washing of the gas and that carried forward to the furnaces, amounted to 24.1 tons, or 5 75 per cent. of the weight of the coal charged.[1] The carbon in this tar amounted to 44,920 pounds, or 6.1 per cent. of the total carbon charged into the producer. The carbon lost in the ashes, and as soot deposited in the gas mains, amounted altogether to 9,666 pounds or 1.3 per cent. of the total carbon charged into the producer. Thus the average amount of the carbon originally charged into the producer, which appeared as permanent gas, was as nearly as possible 92.6 per cent.

6. *Sulphur in the Gas.*—The sulphur originally in the coal amounted to as nearly as possible 19 pounds per ton. Of this, we calulate that as nearly as possible 16.5 pounds, or about 87 per cent., appeared in the gas, chiefly in the form of hydrogen sulphide. The amount of hydrogen sulphide in the gas was of the order of 0.1 per cent. by volume.

In conclusion, we desire to express our best thanks to Messrs. Monks, Hall & Co., for their kindness in placing the plant at our disposal for the purposes of the trials, and for permission to publish the results.

Interior Illumination, with Special Reference to the Meeting Room.[2]

By Mr. T. J. Litle.

I have taken up the question of lighting a public hall from probably a novel standpoint. It is comparatively easy to calculate the number of foot candles required in a certain space for certain purposes, but it is sometimes a little more difficult to design the particular reflector for particular lighting.

In the case of a public hall of any kind, I think it desirable to keep the light source from the eyes of the audience, and while the light is directly in the speaker's eyes, as he stands on the platform and looks down the room, he is only one of a large number. I think it best that the audience should be considered, and practically considered wholly, and for that reason we have adopted a scheme for lighting the room with lamps throwing the light directly away from the eyes of the audience.

Fig. 1 is a diagram showing a section through the room, and a rough layout of the room.

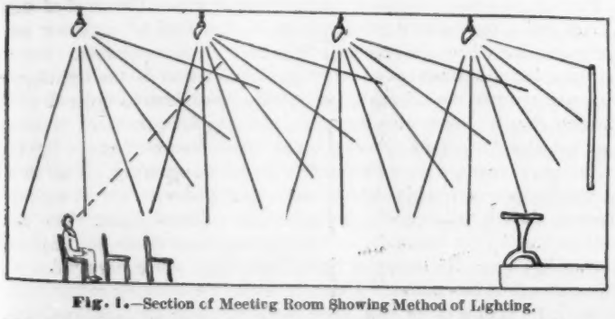


Fig. 1.—Section of Meeting Room Showing Method of Lighting.

The reflectors here shown throw most of the light forward and below, and throw but very little backward. If the audience looks up it will see nothing but the green bowl, and the effect on the eye is not displeasing.

I might say that most of our theaters are poorly lighted, if the lamps were on during the performance, but instead of that we turn them down and bring out the lamps on the stage; otherwise it would be annoying to watch the play. Most lecture rooms and draughting rooms are poorly lighted. In most draughting rooms I know it is objectionable to look up from the board to the lamp. In most college draughting rooms the students face in one direction; that is, toward the instructor at the end of the room, and as it is often necessary to look up, it is annoying to look directly into the lamp. The general design of the lamp should be one which would obscure it by a reflector. In any event, we should never use a bare lamp.

Fig. 2.

The form of lamp shown (Fig. 2) gives a fairly good illumination.

The reflector is made of double blown glass, a green-plated glass, lined with white on the inside, made by dipping the blow-pipe first into a batch of opal glass and then into a green glass, having a composite mass on the pipe and blowing it into the mold which will form the spherical globe; green on the outside and white on the inside, This is then cut off at the angle shown in the picture.

The inner cylinder is frosted around the front half, the back of the cylinder being clear. That is the cylinder which we recommend for this kind of lighting. In this case we have the mantles unobstructed and throwing the full light on to the reflector. As I stand here on the platform I see these frosted cylinders and the inside of the reflector, which combination is not so objectionable as it would be if the cylinders were clear.

The distribution curve shown in Fig. 3 is irregular and may appear

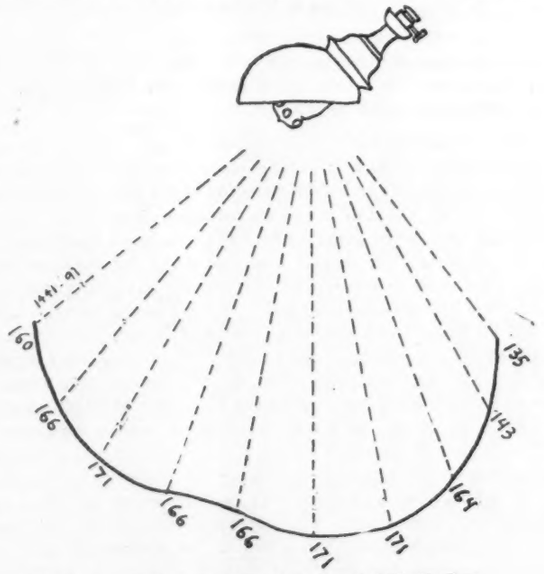


Fig. 3.—Candle Power Lamp of the Inverted Mantle Type.

surprising to some of you. The shade was designed to give a uniform curve, but you see a little lump in the curve that was caused in rather a peculiar way, viz.: By the several thicknesses of the glassware below the mantle. The light at this point passes through three thicknesses of glass.

These lamps are lighted electrically from a central point, the jump-spark ignition system being used, which gives the convenience of electric lighting.

Discussion.

A Member—Have estimates been made of the candle foot illumination on a plane, say, 2 feet 6 inches or 3 feet above the floor?

Mr. Litle—I have not figured it out for this room; we would get in similar installations perhaps 12 or 13-candle feet, but that is a mere guess—probably a high one. The consumption of these lamps is 3 feet per hour; 16 lamps take 48 cubic feet per hour, lighting about 800 square feet of floor surface.

1. The net calorific value of this tar was 2.891 kilogramme C. units per pound; the actual heat lost in the tar was as nearly as possible 5 per cent. of the net calorific value of the coal.

2. Read before the "Illuminating Engineering Society," Philadelphia Section.

A Member—I think the layout in this room is a very desirable one for the type of unit used, but I also think that the high intrinsic brilliancy displayed is not so desirable, inasmuch as too much illumination is as bad as too little. If the lamp were lower in intensity, it would present a more pleasing appearance. However, as the lecturer remarked, halls are sometimes furnished with dark coloring on the walls, which absorbs a certain amount of light and in that case the glare might be softened.

Mr. Litle—Of course, all of us have different ideas as to the proper kind of light for a given purpose, just as physicians have different ideas on the proper kind of milk to give a baby, and it is hard to lay down a law which would suit us all. I myself like a large volume of light, so long as the source is not visible. I get very sleepy in a light of low intensity, and do not concentrate my gaze properly on the speaker.

Mr. G. R. Green—Is it possible to turn the lamps down?

Mr. Litle—Yes, the lamps can be turned down by simply turning the checks on the burners. There is a thumb piece on the side of the burner by which you can get any candle power you like.

Mr. C. W. Pike—However much we might argue with the speaker as to the proper intensity of illuminants—and I would agree that the intensity is higher than needed—at the same time, I think this particular illumination is useful in allowing us to contrast it with the very low degree of illumination that we have with the electric light, as even with this very great illumination I think you will agree that the ease on the eye is very much greater—that there is a marked rest—as compared with the electric illumination. The method of illuminating shown here is illustrated in actual practice in one of the rooms of the Engineering Department at the University of Pennsylvania, in the lecture room of the Architectural Department, but they have one modification, which is, that the fixtures are placed back a little, and are so designed that none of the direct rays of light come directly upon the screen so that it is not necessary to change the illumination of the room at all when the lantern is in use.

A New Profession.

Under this caption there appear, in the May issue of Editor Livingston's handsome *Gas Logic*, a few paragraphs that are quite to the point. Editor Livingston says:

Within the past decade a new profession has come into being, offspring, like many other new professions in this day and generation, of conditions quite novel and unprecedented in the history of civilization. This new calling is that of the illuminating engineer.

Up to the time when giant office buildings, huge apartment houses and the universal use of gas and electricity for lighting purposes became facts to be reckoned with, there would have been absolutely no place for the illuminating engineer. So long as the average man illuminated his house and his office by means of lamps, placed where they best suited his convenience, had daylight for most of his business and cared but little for the artistic effect of his surroundings, a man in his profession would have been reduced to absolute starvation—and this is not a figure of speech; he would have had no income whatever. But with the advent of the office building, the steel frame and the elevator and the consequent immense increase in the value of space, the economy of light became a problem requiring the nicest judgment and the most thorough knowledge. The increased pace of business also made night work more common than it used to be, and people began to realize that unless they had good light for their work there would be large oculists' bills to pay, and more or less unsatisfactory work as well.

In short, the question of the economy of light became, figuratively as well as literally, a burning question.

That the placing of lights correctly makes an immense difference in their effectiveness is one of those obvious truths which everybody knows who stops to think; but as the majority of mankind is too busy to stop and think very often, it follows that somebody finds it profitable, as a rule, to do neglected thinking for it. Men who studied the lighting of buildings soon discovered that the rules about the placing of lights are as much an exact science as geometry. They found out the exact difference in the strength of a light placed in the middle of a room and the same light placed at one side, and how the use of different colors in decoration affected the illumination of a room. Most people know, in a vague sort of way, that a dark room will look darker with a deep red paper on the wall than it will with a light gray one, and that a room which gets the sun will be more attractive in one sort of paper, while one with a north exposure, or a window opening on an air-shaft, will look better with another sort of wall covering. Here and there is a householder with that sixth sense which we call color sense, who knows by a subtle divination just how to use colors in papering and painting, but most people are not born with that faculty. Architects and builders are not by any means certain to have it. Hence the necessity of the illuminating engineer—the man who has a liking for such problems and has studied them scientifically, so that there is no guesswork about his decisions.

As Beethoven wrote music when stone deaf, and as the astronomer can tell you the position of a comet which he has not yet seen, so the illuminating engineer can work out, from the dimensions and position of a room, the scheme of decoration and the exact number of lights it ought to have.

He knows that the number and brilliancy of lights in a room do not necessarily guarantee a proper illumination. He also knows that a great deal of light is absolutely wasted in the average building by being ill placed, and he knows where and how this waste can be saved.

Diagrams make it possible for the illuminating engineer to know exactly what the intensity of any light is and, more than this, the illuminating power it has in any given surroundings. He can determine not only where a light should be placed to give sufficient illumination to a room of given size at the least expense, but what colors should be used on the walls and ceiling of this room in order to get the greatest possible benefit from the light.

Illuminating Engineering in Central Station Work.

By Mr. W. W. Edwards.

In the paper offered in the prize competition instituted by the Co-operative Electrical Development Association, was an excellent one by Mr. W. W. Edwards, Edison Sioux Electric Company, Sault Ste. Marie, Mich. The author said:

A good deal of attention has always been given to the tracing and stopping of central station losses, but these investigations have seldom been pursued beyond the consumer's meter, thus stopping at the very point where they should have been continued. It is becoming more apparent every day that some of the most important losses in central station lighting service are to be found in the consumer's installation, n the selection and arrangement of lamps and the form and nature of globes and reflectors employed. The consumer at this aritical stage is commonly left to his own devices. It is needless to say that the average consumer understands little of the principles governing interior illumination either for residence or commercial purposes, hence the result can easily be imagined.

One cause of dissatisfaction and decreased earnings is found in the fact that the ordinary incandescent lamp is allowed to remain on the circuit long after it has become dim and blackened, and very often until burned out. This is not only a fruitful source of complaint, but the decrease in the conductivity of the lamp constitutes in the aggregate no small loss to the lighting company.

There is no branch of central station service where the need of expert advice and supervision is greater than in the field of lighting, nor is there another where the returns are greater or more certain. Some of the complex situations encountered in this division of the lighting service will require considerable study and comparison in order to obtain the best results; hence the necessity, not only for persistent investigation but also for a keen observation of the different effects in lighting.

As to equipment, a good photometer is a prime necessity. This should be mounted on a suitable carriage and equipped with a full supply of screens, also an attachment for studying reflected light. The latter will be found very valuable, as reflected rays constitute an important part of lighting; the irregular or diffused light being highly desirable for residence illumination. A simple device for studying reflected light is in the form of a large box lined with black cloth, and entirely inclosed except an opening for observation of the interior and a much narrower one for the admission of artificial light. Through this narrow opening a direct ray of light is thrown upon a small reflector, the light being reflected upon any desired surface placed on the opposite side of the interior. By placing samples of wall paper instead of the reflector, the comparative reflecting properties of different shades and qualities of paper may readily be ascertained; however, this is only a suggestion, but a dark room of some kind is very necessary in this work.

In addition to the photometer, an indicating wattmeter will be neces-

sary or at least very desirable in measuring the load of the different installations. A reliable voltmeter will also be convenient. Each workman in this department shall possess a set of hand tools such as are used for interior wiring. The department should be supplied with samples of all globes and reflectors in common use, to be employed in making experimental tests.

Besides the above named equipments, the department itself will invent many devices to aid in the successful conduct of its work. Most of these, as well as the photometer, will be used mainly in testing and making comparisons; a kind of laboratory practice the results of which will be used in actual practice, where the different lighting effects are noted almost entirely by the eye.

There are at least two prime essentials for good service from incandescent lamps. First, there must be central station control of the lamp supply and renewals in order that the proper efficiency, size-type of lamps may be intelligently selected and used, and that dim and blackened and burned-out lamps may be properly removed from the circuits. Second, there should be a periodical overhauling of lamps in circuit, inserting new lamps in place of those which have passed the period of their useful life.

First in order is the work of installation as applied to residence and commercial illumination. When an application is made for electric lighting, the interior wiring of the building usually having been done by contractors, an installation order is made in several copies at the office by means of carbons, a copy being sent each department having work to do on the installation.

The service department at once runs service lines to the building, or merely connects them as the case may be, while at the same time a man from the illuminating engineering department makes an inspection of the premises, and assists the customer in the selection of lamps, reflectors, etc., best suited to the purposes for which each is to be used. Every detail necessary for the satisfactory lighting of the premises is considered before leaving, the quality as well as the quantity of the light receiving attention. The customer is thus given to understand from the beginning that the company understands its business and is determined to insure for him the very best results possible. Too much stress cannot be placed upon the importance of establishing and maintaining this favorable impression on the part of the customer.

Improvement in existing lighting service is the next step. Naturally, any complaints regarding unsatisfactory lighting service will receive first attention. Uniformity and promptness of action are secured by means of an operation order which, like the installation order, is issued from the office and is made in more than one copy if the attention of other departments is desired.

Whatever the difficulty, it is located and remedied, even though it involves radical methods and some expenditure. Complaints have always existed in a greater or less degree, but it is hoped and confidently expected that with the advent of the illuminating engineering department this class of complaints will entirely disappear.

In this connection it may be well to mention two existing difficulties which will cause the new department no little annoyance. One is the tendency on the part of those doing interior wiring to allow for only a limited number of outlets or not to distribute them properly, regardless of the fact that as much depends upon the efficient use of a lamp as upon the efficiency of the lamp itself. The other difficulty lies in the color and quality of wall and ceiling paper and the shade of interior finish. Many customers will select sombre green or other dark color, apparently ignorant of the fact that this shade of paper is a powerful absorbent of light and will not reflect more than 12 per cent. to 20 per cent. of the light thrown upon it. While this results in an increase of energy, the gain is more than offset by the annoying complaints of the customer and the misleading reports which he will circulate in regard to the cost of electric lighting.

The opportunities for improvement in lighting efficiency are many, but in most cases the obstructing ideas of existing carelessness must be located by persistent search. The adjustment of a few complaints is only a beginning. The real aim of this department can be accomplished only by a systematic examination of the premises of every customer on the circuits. In some instances, quite extensive alterations may be necessary, but a satisfied customer is a good customer to have. In order to demonstrate the advantages of making certain changes, it may often be desirable to temporarily install a different kind or size of lamps, with suitable reflectors if necessary, the customer signing a temporary installation receipt therefor. The consumer is at all times given the benefit of valuable advice regarding illumination, and will soon learn to consult this department before making any change in his lighting installation.

The improvement of street lighting will usually require only limited attention after the first year unless some general change is made in the style of arc lamps or in the character of globes and reflectors employed, such as to necessitate a different elevation of the lamps in order to obtain the best service therefrom. In case a narrow street renders any change necessary in the height of the lamps, or the proximity of a dark alley makes a different kind of a globe or reflector desirable on an individual lamp, the new department will report the same to the office with particulars. A regular operating order will then be issued to the department having charge of this work.

Great diversity of opinion exists in regard to the proper stage at which it is profitable to remove the incandescent lamp from the circuit. Many central station companies in the smaller cities make no attempt whatever in this direction, except to furnish free renewals as an inducement to customers to return lamps when burned out.

In every well-conducted electric light business the renewals of incandescent lamps are carefully recorded and form one branch of distributing expense; hence the manager knows the monthly expenditure for this purpose, often regarding the same as a direct loss. Though not strictly a part of the subject of this paper, a few reasons are here given for the following plan of renewing lamps.

The useful life of a 3.1-watt lamp at normal voltage is estimated by good authority to be 400 hours to 450 hours, the 3.5-watt lamp about 800 hours; at which time the candle power has fallen to about 80 per cent. of rated value. Practical test demonstrates the fact that a lamp which has passed the above period will not conduct as much current as before, the difference increasing with every hour the lamp remains in service.

It is true that the lamp will require more current per candle power of light delivered, because the candle power decreases faster than the consumption of current, caused in part by the deposit of carbon on the inner surface of the glass bulb, causing it to become blackened. On the other hand, the total amount of current passing through this lamp in a given time will be less than in the case of a new lamp, chiefly because of loss of conductivity in the carbon-treated filament of the old lamp. It is safe to say that thousands of dollars are wasted annually by lack of attention to this important principle, enough to repay many times the extra cost of renewals.

The habit of allowing lamps to remain on the circuit after passing the period of their useful life is, therefore, not only an injustice to the customer by reason of decreased candle power, but a direct reduction in the earnings of the lighting company. For these two reasons it is imperative that a systematic renewal of lamps be made at stated intervals, these being more frequent during the winter months. Any desired conveyance may be used for this purpose, from a one-horse wagon to an automobile. A record book containing a record of the number and candle power of lamps, both delivered and returned, is signed by the customer. In this way the accounting department may not only compute the cost of renewals, but also note any slight changes of candle power in the customer's installation. Lamps are obtained from the store room upon requisition, the same as other supplies. Thus the brilliancy of the incandescent lighting service is maintained unimpaired, resulting in the satisfaction of the customer and in a substantial increase in the earnings of the lighting company.

Whatever may be the means employed, the engineering of illumination demands and must have prompt attention if electric energy is to hold its own in the field of modern lighting.

The Government Tests on West Virginia Coal.

Many coal users are interested in the matter that led up to the first report issued by the U. S. Geological Survey late last month. From the figures so far given as these have been sent to the newspapers, it is tentatively shown that the value of West Virginia's bituminous coal for gas producer purposes is pronounced. The experiments of the Geological Survey were made at St. Louis at the time of the Exposition in 1905. The original testing plant is still there, but it is quite probable that it will soon be removed to Wheeling or to Pittsburgh. The experiments, which were many and carefully conducted, go to show that far more power can be got from bituminous coal when used in the gas producers than when consumed in the ordinary way in a steam engine. For the production of 1 electrical horse power hour in a producer gas plant there were required 1.57, 1.29, 1.46, 1.78, 1.40 and 1.50 pounds of dry coal, respectively, but to produce the same results in a steam plant it took 3.90, 3.62, 3.55, 3.63, 3.46 and 3.53 pounds. These tests showed gains in efficiency over fuel used in a

steam plant of 148, 181, 143, 147 and 135 per cent. respectively. Another test showed but 1.03 pounds of dry coal needed in a gas producer, but 3.54 pounds were necessary in a steam plant to produce the same result. These results indicate a revolution in the production of power. Experts of the Geological Survey declare that gas producers and gas engines are destined in the near future to replace to a very large extent the ordinary steam engine. No other result seems possible when manufacturers fully understand what they can effect by the use of the producer gas engine.

A Seamy Side of Municipal Ownership.

Our consul at Palermo, Italy, Mr. William Henry Bishop, has been calmly looking over the situation there in respect of municipal ownership, and he finds that:

"The past year has been marked by a considerable increase in the movement toward municipal ownership. The acquisition of the existing gas plant was voted, under a referendum, in April, 1906, there being 7,988 votes in favor, against 112 opposed, out of a total electorate of 18,821. The management was assumed by the city on November 1, the sum paid being 4,750,000 lire ($916,750). The working force in the service of the private Company was retained, and one of the first measures taken was to reduce the hours of labor of an important part of this force from 12 to 8 per day, thus creating in that respect a higher scale of expense. No lowering of the price of gas is expected at present. Indeed, much protest has already been made by consumers on that account and also on account of its alleged poorer quality, together with a lack of sufficient pressure to deliver it properly to the more distant parts of the town, while the endeavor to get such pressure increases the bills of those living near the distributing point. The Mayor issued an explanation, stating that a large addition to the system of piping is needed, and asked the public to have patience till the various difficulties of the new enterprise can be overcome. The committee of management, offended by the severe criticism to which they were subjected, resigned. Following upon this, the Municipal Council resigned in a body and the Mayor with them, but it is hoped that these resignations will be withdrawn.

"The price of gas remains at 24 centimes per cubic meter, equivalent to about $1.36 per 1,000 feet. This includes a tax of 4 centimes the cubic meter imposed by the national and city governments, one-half by each. Gas for cooking and industrial purposes is a trifle less, but as it is necessary to rent a separate meter for it the difference, where consumption is moderate, is scarcely worth mentioning."

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE concern known as the Baltimore (Md.) Suburban Gas Works Company, which was put in the field by Mr. Joseph Schreiber and associates something over 2 years ago, to supply gas in certain suburban districts of Baltimore, has been purchased by Mr. Henry G. Runkle and associates, of New York. Whatever may be the ultimate outcome of this bargain and sale, the one certain thing is that the property is in the hands of men of probity and business capacity.

MESSRS. FRANK ZINNEL, Arthur C. Woodruff and R. O. Howe have filed papers incorporating the Savanna (Ills.) Gas and Heating Company. The Company is capitalized in $40,000.

MESSRS. H. A. SCHLUCKBEIR and Edward Beichl have applied to the authorities of Beaver Dam, Wis., for the right to construct and operate a gas works of the coal type. Both are residents of Beaver Dam, and are responsible men.

MR. A. D. MACKIE, of the Peoria (Ills.) Gas Company, sang his swan song at the Creve Coeur Club, Peoria, the evening of May 27th. It was only the swan song of his bachelorhood, however, for he became a married man the evening of the 4th inst. Good luck, to them.

THE Connecticut Legislature gave leave to withdraw the petition of the Stamford (Conn.) Gas Company to increase its capital stock.

MESSRS. R. D. WOOD & CO., of Philadelphia, are under contract to construct a holder up to retaining 500,000 cubic feet on the plant of the Moline (Ills.) Peoples Power Company. It is to be ready for work by September 1st.

THE Suffolk Lighting Company, which proposes to construct and operate a gas plant for the supply of Babylon and Argyle Park, L. I., has applied to the New York State Commission of Gas and Electricity for the right to issue stock in $40,000, and bonds in $75,000.

THE Yakima (Wash.) Gas Company has, through Mr. I. P. Englehart, got together the funds necessary for the reconstruction of the gas plant in that place.

THE reports of the Kansas City (Mo.) Light and Railway Company for the months of April and May, show net earnings equivalent to a return of 5 per cent. on the preferred and 6¼ per cent. on the common stock.

THE loss on the gas, electric light and power station of the local company at Bloomington, Ills., was originally reported at $5,000. However, we are glad to say it was less than one-fifth that sum.

THE H. M. Byllesby Company has been retained as Consulting Engineer for the Sioux Falls Light and Power Company, of Sioux Falls, So. Dak. A part of the work at this point is the arranging of a power plant on the Big Sioux river; the calculated head of which is put at 80 feet.

A COMMITTEE from Kaukauna, Wis., appointed to investigate and report upon the mission of success attending the operating of the public lighting plants at Bellefontaine, O., has made its report. The thought was that if the thing was right at Bellefontaine it would certainly be "a go" at Kaukauna. The report, however, puts "the thought" to rout, for it was all against the Bellefontaine example.

AT the annual meeting of the Consumers Gas Company, of Reading, Pa., no change was made in the executive management.

APPLICATION has been made, before Chancellor Stevens, of Newark, N. J., for the appointment of a Receiver for the Dover, Rockaway and Port Oram (N. J.) Gas Company, by Mr. Chas. G. Cornell.

MR. J. N. FINDLAY, whose pseudonym of "Chippy" is known to almost every gas man in America, and whose cheery laugh provokes many a chorus of jolly sound, had the satisfaction on May 27th, of turning the valve leading from the new plant of the Goshen (N. Y.) Illuminating Company to the street mains of the system. Everything moved without a hitch, and that the residents have reason to appreciate that which Mr. Findlay has done and proposes to further do for them would seem quite plain from the following extract from an article that appeared in that sterling old newspaper, the Goshen *Democrat*, dated the 30th ult.: "The difference between the new gas and that made by the old system is remarkable. The new product is of greatly superior quality. * * * The new plant is pronounced by experts to be one of the finest of its size in the country." "Chippy" never "did things by halves."

THIS despatch is dated May 29th: "The Hamilton (O.) Gas and Electric Company, which has been selling gas to the city on wholesale account at 35 cents per 1,000 cubic feet for distribution on municipal account through the municipal mains, has notified the authorities that hereafter they will have to pay the same as its regular, commonplace, ordinary consumers—65 cents per 1,000 cubic feet.

SOL. LOWENSTEIN, George L. Lewis and J. R. Frankenberg, as the Lowenstein & Frankenberg Gas Regulator Company, have applied for incorporation to the Governor of Pennsylvania. The character and object of the concern are to manufacture and sell gas saving regulators. The Solicitor of it is C. S. Crawford, 1308 Berger building, Pittsburgh, Pa. It might be well to keep an eye on this concern.

"R. D. C.," writing from Noblesville, Ind., under date of the 1st inst., says: "Mrs. Helen Armstrong, who gave a 6-day course of lectures and demonstrations for the Noblesville (Ind.) Gas and Improvement Company, beginning the 27th ult., met with a great reception from the consumers and the residents. The first lessons were given in a large storeroom which was really so crowded beyond its capacity that the Company was obliged to engage the Opera House for the balance of the week, and that edifice was also well taxed. The proprietors of the Noblesville Gas and Improvement Company assert that they have on their ledgers a greater number of gas consumers than any other city or town having a like population. The figures at Noblesville in relation thereto stand: Population, 6,072; consumers, 1,220."

MR. HENRY W. SAGE, the one time (and a good, long time it was) active and successful Secretary of the Cincinnati Gas Light and Coke Company, now the Cincinnati Gas and Electric Company, is living

like an Esquire in Lawrence, Kas., enjoying the society of his wife and daughter. He was in Cincinnati recently, and Mr. Kenan and the Sage gentleman had many a reminiscence to compare. That which this pair know about the gas lighting of the Queen City, if bound up, would make a very readable volume.

THE women of Winnetka, Ills., have presented the following petition to the Trustees of that settlement—this document had affixed to it 206 signatures:

"We, the undersigned, long suffering women of Winnetka, do most humbly and earnestly entreat your most honorable body to listen to our plaints.

"For 12 years there has been much entertaining talk of a gas plant being erected in our village. Through all these long years no fruit has been seen from this cultivation, only blossoms, sterile and useless, that one might expect from a botanical specimen of this nature.

"The season of sweltering days and warm nights approaches, the season when kitchens with coal ranges become well nigh intolerable, the season when the households that are fortunate enough to have cooks hear their threats that a coal range will make it impossible for them to remain in Winnetka throughout the summer.

"This is the season when the patient mother turns over in her mind whether she dares imperil her family and household by introducing into its midst the deadly gasoline range or equally objectionable kerosene stove. She feels in her secret soul that could the honorable council of Winnetka be compelled to cook for one hot July day the food for even one small family, by the side of an anthracite stove, this talk of gas in the village would cease and action take the place of words.

"Consequently we, the undersigned, do humbly beseech your most honorable body to bestir itself, to stop listening to the reports from this and that committee, to break up this lifelong habit of 'collecting data' about gas plants, and to put good, cheap fuel gas into our streets, gardens, parkways, and anywhere else it can best go and thus distinguish yourselves from your procrastinating predecessors, who for the last 12 years have been talking gas and doing nothing else."

MR. A. B. MORTON has resigned the position of Manager of the Bowling Green (O.) Gas Light Company to take on the Superintendency of the gas and electric lighting plant that is being operated on public account in Wakefield, Mass.

THE new offices of the Wilmington (Del.) Light, Power and Traction Company in No. 838 Market street, that city, compare favorably with those of any of the many large manufacturing concerns centered there.

THE new works for the supply of gas in Pendleton, Ore., were put in active work the afternoon of May 26th. The first charge was made by the wife of ex-Governor Geer, who now is certain that a stoker's lot is not a happy one.

MR. G. TRACY ROGERS, President of the Rutland (Vt.) Railway, Light and Power Company, is responsible for the gift of free gas to the Rutland Women's Club for use in connection with the Club's domestic science demonstrations.

MR. L. S. CURTIS has resigned the position of General Manager to the Houghton County (Mich.) Gas Company. His successor is Mr. Max H. Cutcheon.

MR. H. J. GILLE, formerly Manager of the St. Paul (Minn.) Gas Light Company, has assumed charge of the commercial department of the General Electric Company, in Minneapolis, Minn. Mr. Gille joined the electric division of the Gas Company, April, 1898.

A TANK (of wood, the newspapers say) which supported a holder used in storing gas at Sea Side Park, Long Beach, Cal., "snapped in twain the night of May 21st, as the result of the corrosive action of the salt air and salt water." Just whatever that may mean.

THIS is a pretty good showing for a Company that pays more attention to its electric division than to its gas division—it is known as the North Shore Company, and does business in the towns on the North Shore of Chicago's great lake:

Gas Sales May 1, 1902, to May 1, 1907.	Quantity, Cubic Feet.
1902	14,500,000
1903	31,470,000
1904	48,349,000
1905	65,007,800
1906	90,079,600
1907	101,171,400

The balance of the showing is like this: 1902, meters set, 420; ranges, none; arc lamps, none; 1906, meters, 2,943; ranges, 1,926; arc lamps, 576; 1907, meters, 3,863; ranges, 2,776; arc lamps, 871.

MR. HENRY W. FRUND, for several years a Director in and Manager of the Vincennes (Ind.) Light and Power Company, is now in charge of the Salisbury and Spencer Railroad, with headquarters in Salisbury.

THE residents of Dearborn, Mo., are anxious to secure a gas supply. It is not at all unlikely that the Union Gas and Traction Company, of Kansas City, will undertake the work. To that Company it would only mean a liberal pipe extension.

THE gas main system of Duluth, Minn., is to be largely extended. The clamor for gas from the west side development of the city has been rigorously in evidence for well on to a year.

MR. W. C. KENNEDY, Secretary of the Windsor (Ont.) Gas Company, joined the ranks of the married division last month. On his return from the wedding trip—that is, some evenings after his return—he ventured out to the Windsor Club. He noted there was a marked symptom of pernicious activity in the main room, and in a short while he was called upon to listen to a speech and to accept a handsome cabinet well filled with silver goods which his wife and himself will find useful later on.

MANAGER H. C. CRAFT, of the Pittsfield (Mass.) Coal Gas Company, has agreed with the Aero Club of America to furnish it with all the gas necessary for the inflation of any balloons that will make ascensions from that city this summer. A great many aerial flights will be made from there the next three months, and probably the three most noted aerial voyagers are: The Mercury, which takes 58,000 cubic feet; the Orient, 38,000; the Wilhelm der Grosse, 23,000.

MR. JOHN I. MANGE, manager of the Watertown (N. H.) Gas and Electric Light Company, has engaged in partnership with Mr. Clinton D. Hodge, under the firm name of Hodge & Mange, to engage exclusively in the manufacture of a line of specialties in woodworking.

MR. BYRON L. WATERMAN, of Pawtucket, R. I., has been elected Treasurer of the Woonsocket (R. I.) Electric Machine and Power Company, vice Mr. Ed. F. Allen.

THE Trenton Gas and Electric Fixture Manufacturing Company opened its commodious factory and handsome showrooms—both are located in the premises, 518-520 Perry street, Trenton, N. J.—the afternoon of the first inst.

THE natural gas supply for Louisville, Ky., is virtually at an end; the Meade field, from whence the gas is piped a distance of 20 miles, showing undoubted symptoms of exhaustion.

JOHN C. DAVIES, now a member of the New York Commission of Gas and Electricity of the Hughes bunch that are to act on that wonderfully odd body which is to be known as the Public Utilities Commission, or whatever else its "legal title" may be, is a candidate for a place.

GENERAL JOHN P. HARBISON, as President of the General Electric-Gas Company, of America, recently informed a reporter of the Hartford *Times* that the experimental plant for Butler, N. J., is under construction. It is said that Mr. Kinney, of cigarette manufacturing fame, is interested in the development of the Electric-Gas Company.

To complete our former mention of the changes in the executive management of the Louisville lighting supply, the following is given: Mr. F. M. Sackett, President of the Louisville Gas Company, has been elected President of the Louisville Lighting Company—that is the electric division of the Louisville Gas Company. The other officers chosen were: Vice-President, Mr. Harry Bishop; Secretary and Treasurer, T. B. Wilson; General Manager, A. M. Worthington. It was decided to go ahead with the work of constructing the new office building on Chestnut street, east of Fourth avenue. That structure willl be a credit to the city, and it will also be a monument to the good business sense of Messrs. Snead, Bishop and Barret.

THE betterments to the plant of the Augusta (Ga.) Gas Company, which have all been arranged for by General Manager Schindler, will cost not less than $100,000.

ON the 3d inst. the shareholders of the Tampa (Fla.) Gas Company decided to issue $1,000,000 bonds to bear 5 per cent. on all of its properties, the proceeds to take up existing issues and provide a fund for betterments. Secretary Bruen inclines to the belief that "Jim" Burns and "Frank" Sanchez, to say nothing of "Ferdy" Rodriguez, should be wise enough now to put in gas in their cigar manufactories on "drying account."

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PROPRIETORS.

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ELBERT P. CALLENDER,
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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JUNE 10, 1907.

The Market for Gas Securities.

The net change for the week in Consolidated Gas is a gain in the bid price of 1 point. There is quite a fair sized short interest in the shares, and our impression is that some of the bears will get it good and plenty before the first prox. Brooklyn Union is 106 to 112.

Peoples, of Chicago, is again at the 90 mark. Massachusetts gas, although ridiculously low, still looks a good thing. The regular quarterly dividend of 1¼ per cent. is payable the 15th prox. Users of cast iron pipe will no doubt be gratified (?) to know that the American Pipe Company is earning anywhere from 12 to 20 per cent. on its bunch of stock. It might be well if the gas companies of the country get together a plant on the Great Lakes and put up a pipe founding plant of their own. The general situation looks better than at any time since last December.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JUNE 10.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	120	121
Central Union Gas Co.—				
1st 5's, due 1927, J. & J.	3,000,000	1,000	101	104
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	190	295
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11 000 000	1,000	98	100
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p.ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	108	111
Con. 5's, due 1945, J. & J.	1,500,000	..	104	110
Standard	5,000,000	100	140	150
Preferred	5,000,000	100	155	175
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	104	108
The Brooklyn Union	15,000,000	1,000	106	112
1st Con. 5's, due 1948, M. & N	15,000,000		107	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	¼	⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	500,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106½
Cincinnati Gas and Electric Co.	29,500,000	100	98	99
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	87	88
Preferred	3,025,500	100	107½	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	.	90
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,500	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
Bonds, 5's	10,500,000	..	107½	108½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	89	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,322,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	05
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Massachusetts Gas Companies of Boston	25,000,000	100	57½	58
Preferred	25,000,000	100	83½	84
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	89½	90
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal.	15,800,000	100	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	300	305
First mortgage 6's	600,000	..	..	..
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(*Continued on page 984.*)

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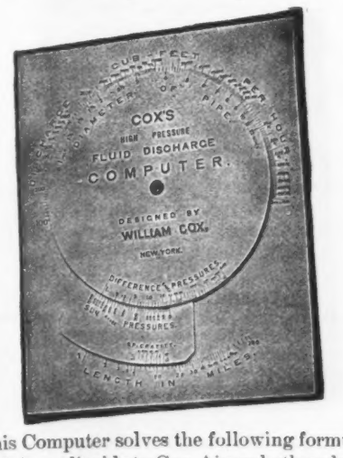

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Discharge in cubic feet per hour at atmospheric pressure $= 33.3 \sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$

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p_1 = absolute initial pressure in pounds per square inch,
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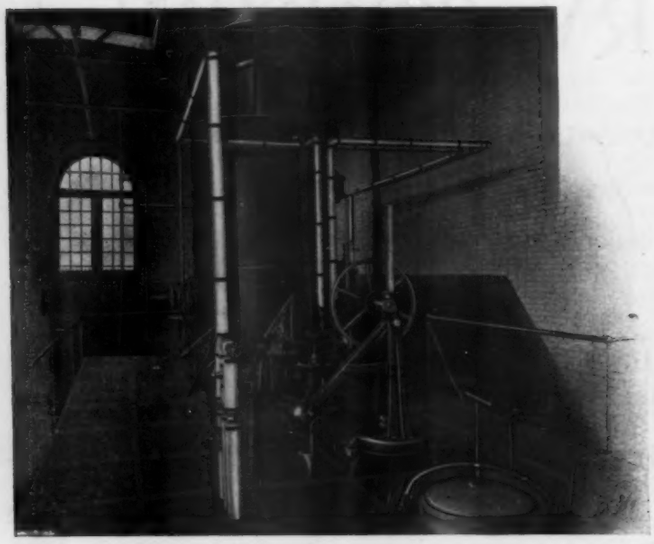

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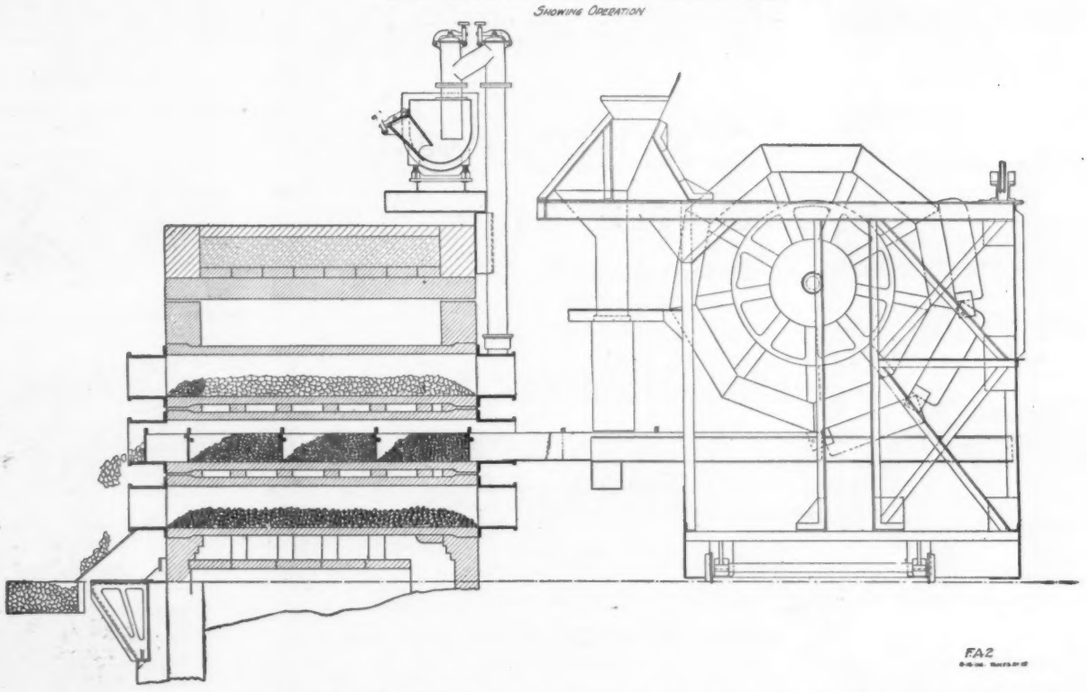

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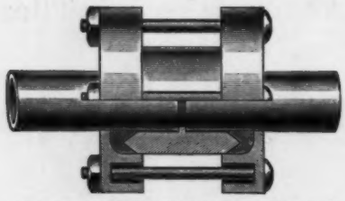
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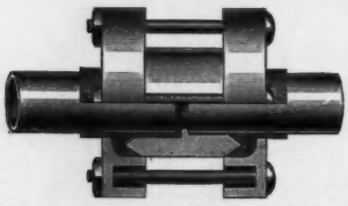
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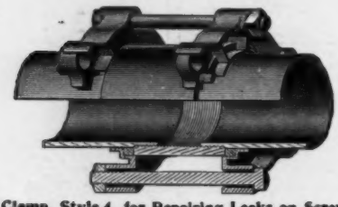
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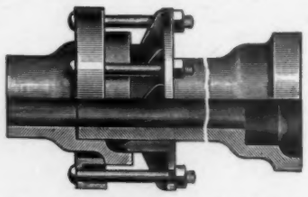
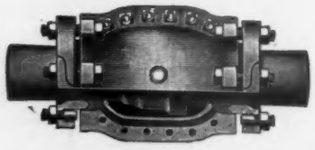
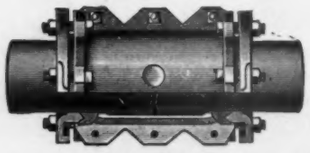
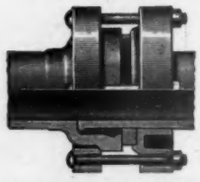
STATE REQUIREMENTS AND SEND FOR CATALOGUE.


Coupling, Style 9, for Special Style Cast Iron Pipe.


Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.


Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.


Clamp, Style 4½, for Repairing Leaky Lead or Cement Joints in Cast Iron Pipe.

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Ramsdell

Our Mantles are the Standard Inverted Mantles, just as the RAMSDELL is the Standard Inverted Lamp. They are manufactured especially for the Ramsdell Lamps, being made of double woven Ramie and bearing our Trade Mark "RICO." Being made on our patented Mantle Ring, a firm hold is obtained on the porcelain cone, which prevents the mantle being jarred off the holder. This is an important feature of the "Rico" Mantles, and is one of the points which makes them the best mantles produced.

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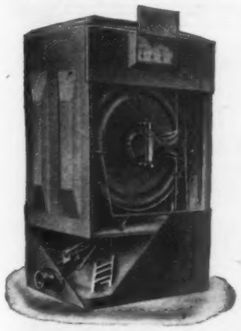

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Saves Over 75 Per Cent. in Cost Annual Repairs.

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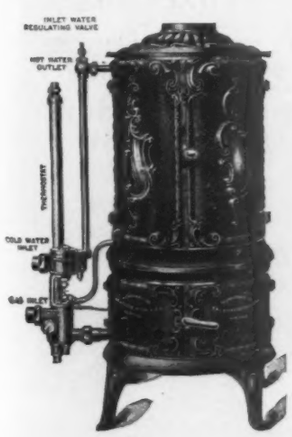

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4. Multiple levers of thermostat all incased. Cannot be disturbed.
5. Simplest Automatic Valve ever made. Can't get out of order.

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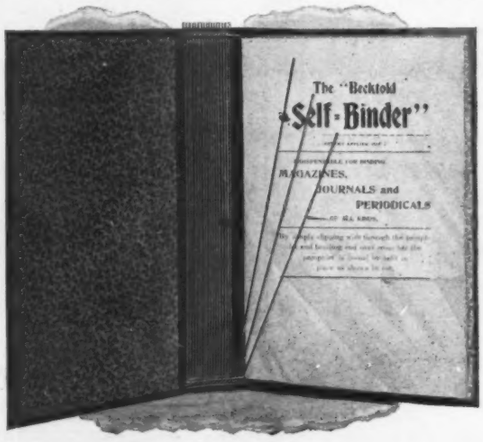

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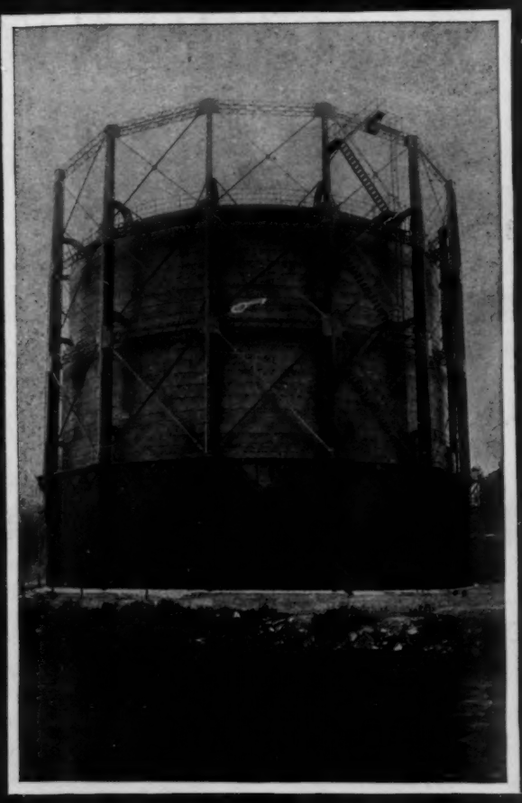

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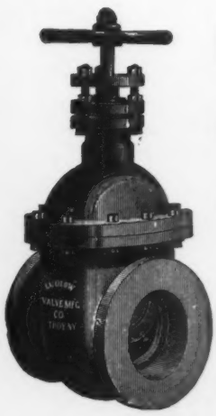

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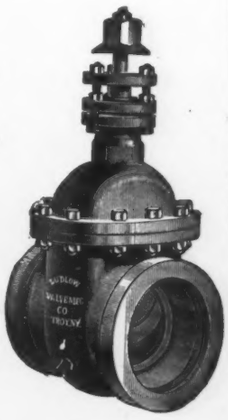

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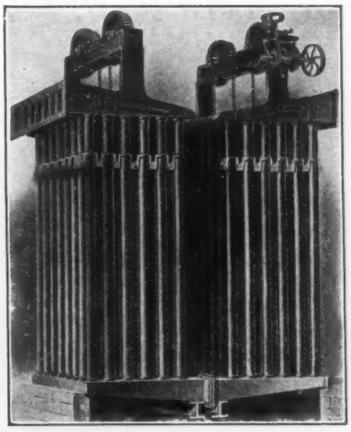

SAVE 15 PER CENT. OF THE COAL IN MAKING WATER GAS.

For every 1,000 cu. ft. of water gas 40 to 48 lbs. of anthracite are consumed in the generator, while 24 lbs. should theoretically be enough. The 40 per cent. to 50 per cent. excess is the margin of possible saving. By passing the hot, waste, stack-valve gases through a GREEN AIR HEATER you can cut down the bill for generator coal by at least 10 per cent. The air forced to the generator is passed through the tubes of the Air Heater and absorbs the waste heat from the stack-valve gases and returns it to the generator. The higher temperature in the generator, carburetter and superheater results, also, in a saving of oil, amounting to about one-fifth gallon per 1,000 cu. ft. of gas.

After the stack-valve gases have passed through the Green Air Heater they may be then passed through a GREEN FUEL ECONOMIZER to heat the boiler feed water, saving as much as 25 per cent. of the boiler fuel. The result is that a Green Air Heater and a Green Fuel Economizer will save from 50 per cent. to 60 per cent. of their first cost annually in a water gas plant. Write for circular "AG" and results of actual tests.

THE GREEN FUEL ECONOMIZER CO.,

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We make all sizes for all classes of reduction,

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And Individual Service Governors for Reducing High Pressure.

HOLDER GOVERNORS

And Low Pressure Regulators, all of the Dry Diaphragm type.

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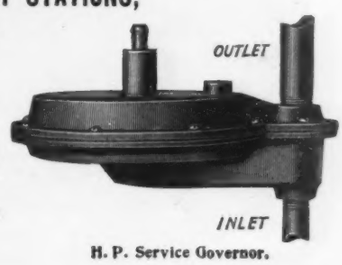

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Maximum Efficiency,
Minimum Back Pressure,
Complete Safety.

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WHY DO GAS EXHAUSTERS

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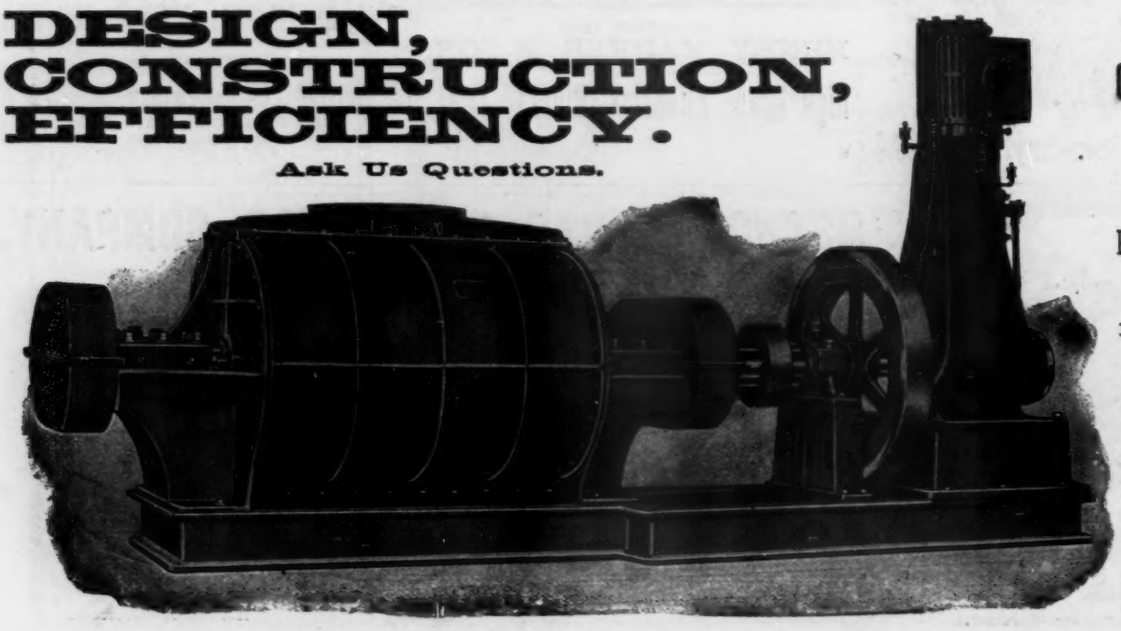
THE CONNERSVILLE BLOWER CO.

Stand so High in the estimation of those using them?

THE ANSWER IS IN THREE WORDS:

DESIGN, CONSTRUCTION, EFFICIENCY.

Ask Us Questions.



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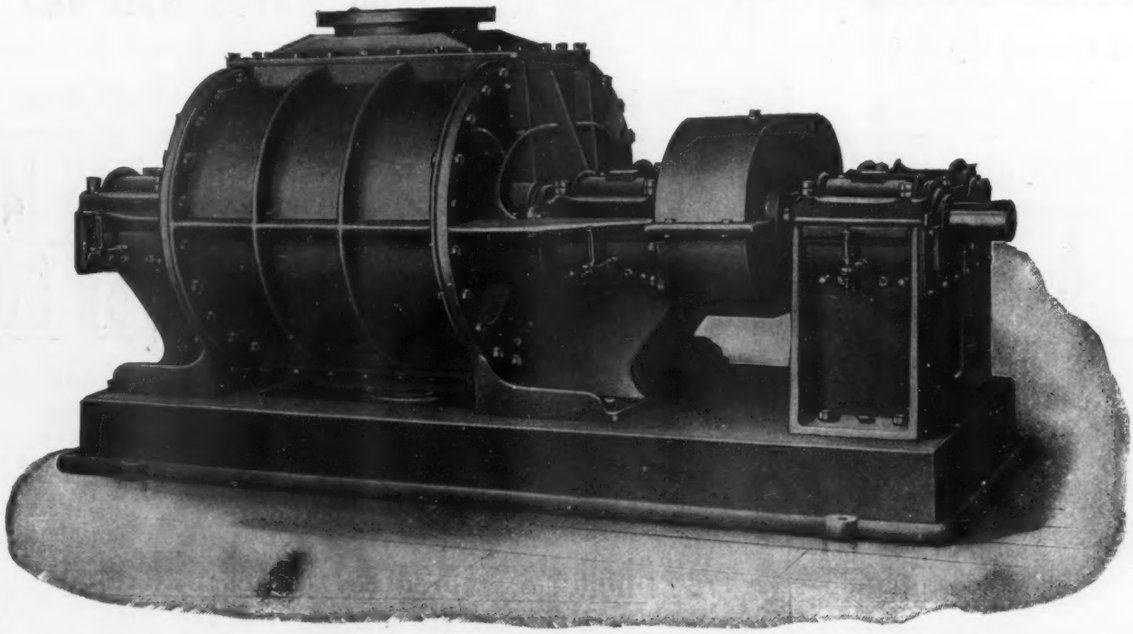
The highest efficiencies obtained. Most perfect devices for adjustment and maintenance of proper alignment. Use our flexible coupling to correct troubles caused by misalignment and engine shaft thrust. Our gas governor is the best. By-pass, gas valves and fittings.



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Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

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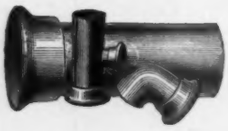

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From Three to Forty-Eight Inches Diameter. Also, all Sizes of

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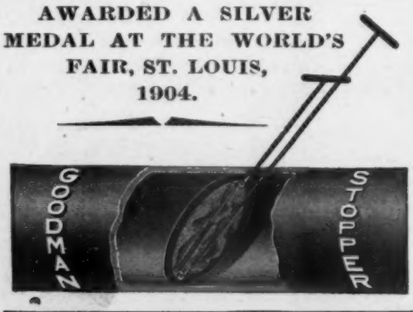

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Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

The Follett Time Stamp

Can be Used for so Many Purposes it would Take a Book to Name them. . . .

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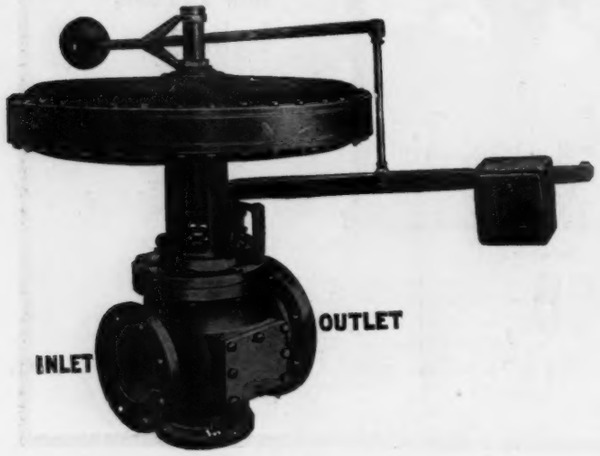

THE FULTON GAS PRESSURE GOVERNOR,

WITH AUTOMATIC SAFETY CUTOFF.

For Artificial or Natural Gas.
For District or Service Use.

Our DUPLEX SENSITIVE GOVERNOR, with Automatic Cutoff for district service, will reduce high pressure gas to inches of water without variation.

Absolutely safe and reliable. No complicated mechanism to get out of order. More than 20 years' experience with the largest gas companies.

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AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

JUNE, 1907.

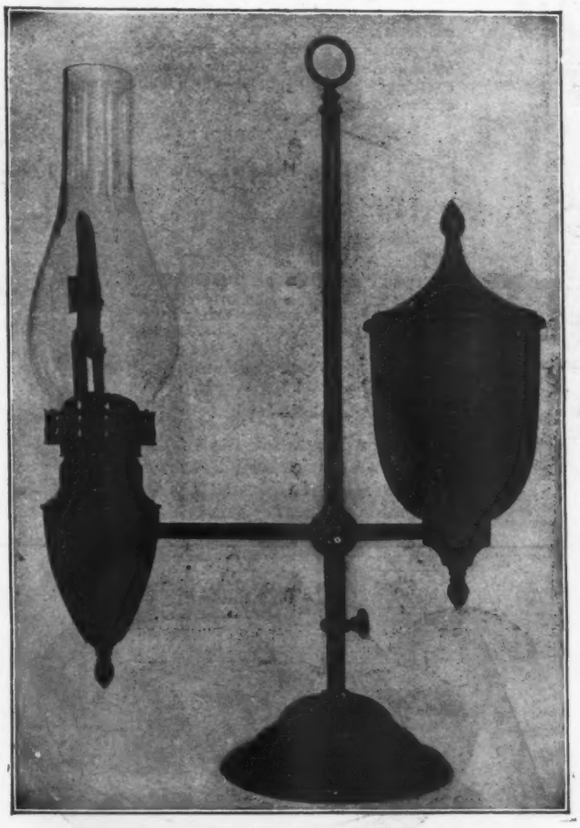
Table No. 1.
FOLLOWING THE MOON.

Day of Week.	Date.	Light.	Extinguish.
Sat.	1	7.50 PM	1.20 AM
Sun.	2	7.50 LQ	1.50
Mon.	3	7.50	2.20
Tue.	4	7.50	2.50
Wed.	5	7.50	3.20
Thu.	6	7.50	3.30
Fri.	7	7.50	3.30
Sat.	8	7.50	3.30
Sun.	9	8.00	3.30
Mon.	10	8.00 NM	3.30
Tue.	11	8.00	3.30
Wed.	12	8.00	3.30
Thu.	13	8.00	3.30
Fri.	14	8.00	3.30
Sat.	15	10.00	3.30
Sun.	16	10.30	3.30
Mon.	17	11.00	3.30
Tue.	18	11.30 FQ	3.30
Wed.	19	12.00	3.30
Thu.	20	12.30 AM	3.30
Fri.	21	1.00	3.30
Sat.	22	1.40	3.30
Sun.	23	2.20	3.30
Mon.	24	No L.	No L.
Tue.	25	No L FM	No L.
Wed.	26	No L.	No L.
Thu.	27	8.00 PM	10.30 PM
Fri.	28	8.00	11.10
Sat.	29	8.00	11.50
Sun.	30	8.00	12.30 AM

TOTAL HOURS DURING 1907.

By Table No. 1.

	Hrs.Min.
January	211.10
February	193.40
March	182.10
April	167.00
May	157.00
June	145.30
July	151.50
August	162.30
September	175.30
October	202.40
November	209.30
December	231.50
Total, yr.	2190.20



THE ELLIOTT KEROSENE STANDARD PHOTOMETER LAMP.

***

10-Candle Power.

***

This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

1st. It uses Standard Kerosene Oil (Pratt's Astral Oil or equivalent).

2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

JUNE, 1907.

Table No. 2.
NEW YORK CITY.
All Night Lighting.

Day of Week.	Date.	Light	Extinguish.
		P. M.	A.M.
Sat.	1	7.15	3.15
Sun.	2	7.15	3.15
Mon.	3	7.15	3.15
Tue.	4	7.25	3.15
Wed.	5	7.25	3.15
Thu.	6	7.25	3.15
Fri.	7	7.25	3.15
Sat.	8	7.25	3.15
Sun.	9	7.25	3.15
Mon.	10	7.25	3.15
Tue.	11	7.25	3.15
Wed.	12	7.25	3.15
Thu.	13	7.25	3.15
Fri.	14	7.25	3.15
Sat.	15	7.25	3.15
Sun.	16	7.25	3.15
Mon.	17	7.25	3.15
Tue.	18	7.30	3.15
Wed.	19	7.30	3.15
Thu.	20	7.30	3.15
Fri.	21	7.30	3.15
Sat.	22	7.30	3.15
Sun.	23	7.30	3.15
Mon.	24	7.30	3.15
Tue.	25	7.30	3.15
Wed.	26	7.30	3.15
Thu.	27	7.30	3.15
Fri.	28	7.30	3.15
Sat.	29	7.30	3.15
Sun.	30	7.30	3.15

TOTAL HOURS DURING 1907.

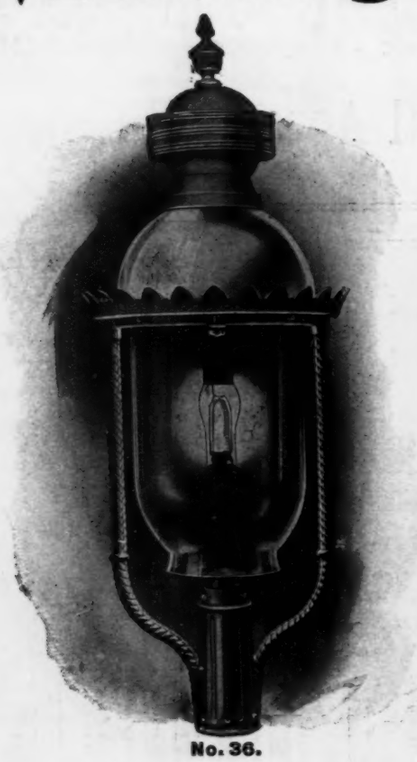
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street. BOSTON, 820 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....



No. 36.

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

INVERTED REFLEX TRADE MARK GAS LIGHT

Succeeds and Excels the Electric Light at One-Quarter the Cost.

THE BURNER.

Elegance of Appearance.
Best Possible Material and Workmanship.
Perfect Combustion.
Lowest Gas Consumption.
Highest Candle Power.
Will Fit Any Fixture.
Will Not Flash Back.
Will Not Blacken Mantles.
Will Not Discolor Fixtures.
Will Not Discolor Ceilings.

THE MANTLE.

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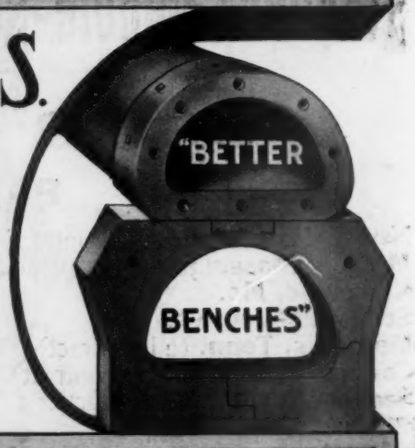

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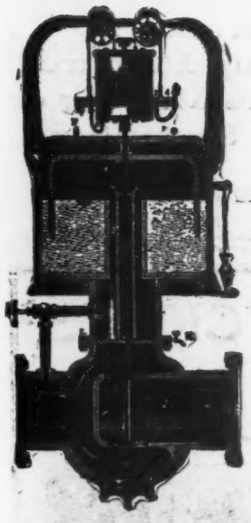

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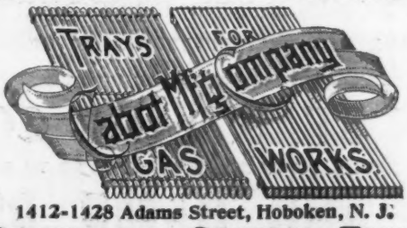

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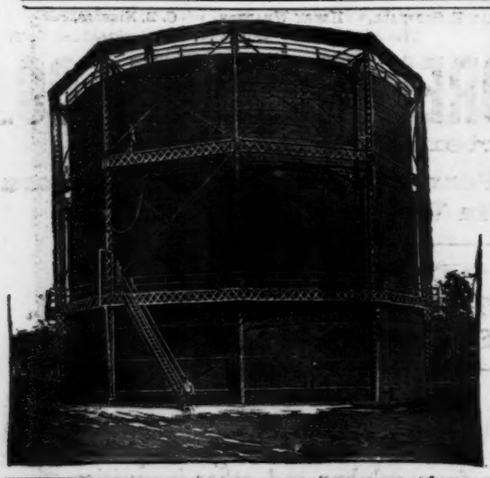

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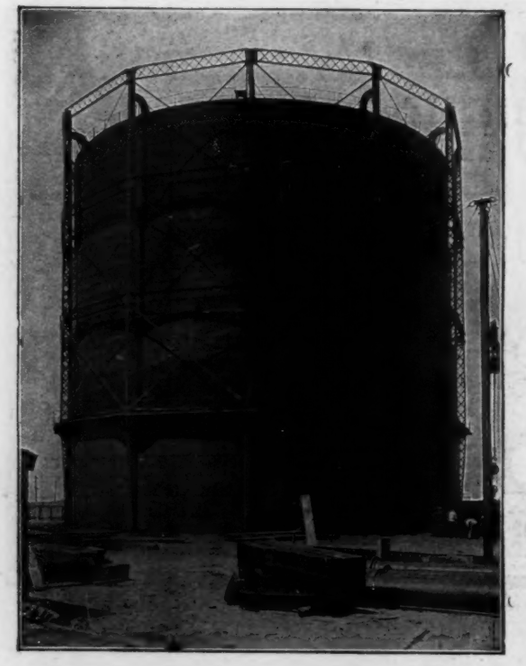

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